Draft Detailed Project Report and Environmental Assessment

Ecosystem Restoration
Ten Mile River
East Providence, Rhode Island

April 2005

US Army Corps of Engineers
New England District

DRAFT DETAILED PROJECT REPORT
AND
ENVIRONMENTAL ASSESSMENT

ECOSYSTEM RESTORATION
TEN MILE RIVER

EAST PROVIDENCE, RHODE ISLAND

April 2005

DETAILED PROJECT REPORT
ECOSYSTEM RESTORATION, TEN MILE RIVER
EAST PROVIDENCE, RHODE ISLAND

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS (continued)

LIST OF PLATES

ATTACHMENTS

APPENDICES

SECTION I

INTRODUCTION

For over 200 years, dams have blocked anadromous river herring (blueback herring and alewives) and American shad from their historic spawning grounds in the Ten Mile River watershed. Anadromous fish live as adults in salt water, but must return to freshwater to spawn. Three dams that prevent the upstream migration of these anadromous fish along the lower Ten Mile River in East Providence, Rhode Island, include Omega Pond Dam, Hunts Mill Dam and the dam at Turner Reservoir. These dams were constructed to provide water supply and/or waterpower for various municipal and industrial purposes, but have eliminated the capacity of this coastal river to support thousands of anadromous fish. This report discusses options to restore this lost productivity.

A December 2002 report, prepared by the Rhode Island Department of Environmental Management (RIDEM), states that the Ten Mile River watershed "is a standout for anadromous restoration". Alewives and blueback herring have been observed at the mouth of the river, and local fishermen from the Slater Mill Fishing Club regularly net the herring and lift them over the dam to spawn in Omega Pond. This activity has helped preserve remnants of earlier fish runs. River herring were also stocked into Turner Reservoir in the mid 1990's by RIDEM to evaluate the spawning and rearing habitat. Juveniles were successfully observed and captured confirming the viability of the river system.

Study Authority

This report was prepared under authority contained in a September 12, 1969 resolution by the United States Senate Committee on Public Works. This resolution authorized the Corps of Engineers to investigate water resources improvements within the southeastern New England region "with due consideration for enhancing the economic growth and quality of the environment."

Restoring anadromous fish passage along the lower Ten Mile River was one of numerous environmental restoration opportunities identified in a July 1999 Rhode Island Ecosystem Restoration Reconnaissance Report, Section 905(b) (WRDA 86) Analysis. This report was prepared by the Corps in response to guidance contained in the Energy and Water Development Appropriations Act for fiscal year 1999. Of the eighteen potential restoration sites identified in this report for further feasibility study, the Rhode Island Department of Environmental Management selected restoring fish passage to the Ten Mile River as their highest priority.

Selection of this site for feasibility scope studies resulted in the preparation of a Feasibility Cost Sharing Agreement. This Agreement specified that feasibility study costs would be shared on a 50/50 basis between the Federal government and the Rhode

Island Department of Environmental Management, the non-Federal sponsor of the study. The Agreement was executed on March 15, 2001.

Purpose and Scope

The purpose of this study was to prepare a feasibility document that evaluates fish passage alternatives, and satisfies the requirements of NEPA. An additional purpose was to establish the level of support and willingness of the non-Federal sponsors to participate in recommended improvements.

Study Area

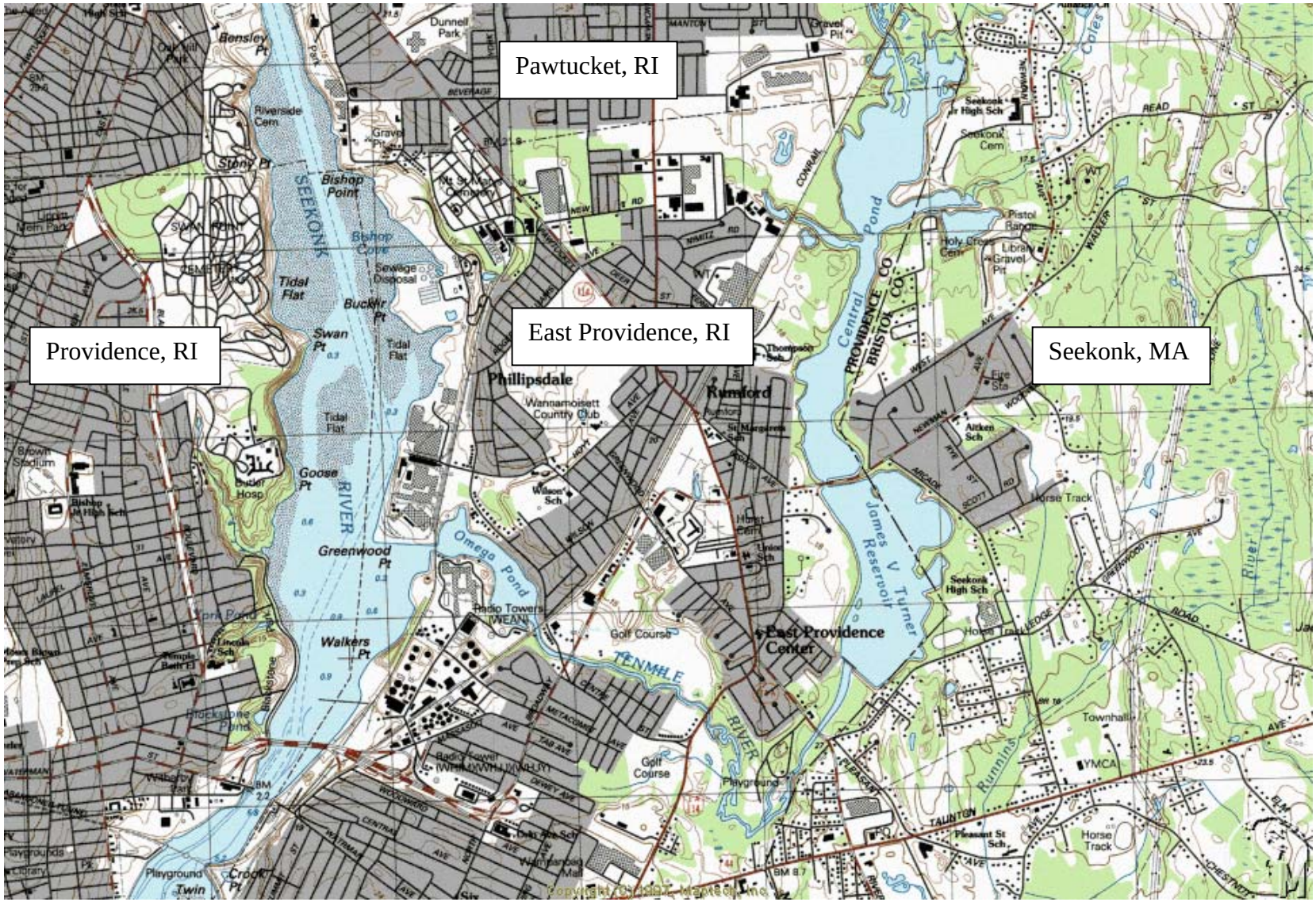
The Ten Mile River is located in East Providence, Rhode Island at the head of Narragansett Bay directly to the east of Providence, Rhode Island. The study area includes the lower portion of the Ten Mile River watershed, with a specific focus toward providing anadromous fish passage at the first (lowest) three dams on the river. These dams are Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam. The study area is shown on Figure 1, and Figure 2 shows the location of the first three dams (fish passage restoration sites) on the Ten Mile River.

The Ten Mile River watershed has a total drainage area of about 56 square miles, with 51 square miles situated in the southeastern portion of Massachusetts and the remaining 5 square miles located in northeast Rhode Island. Adjacent watersheds include the Blackstone, Charles and Taunton Rivers, and the Narragansett Bay watersheds. The Ten Mile River originates at Cargill Pond in Plainville, Massachusetts at an elevation of about 230 feet. From this point the river flows south through urbanized portions of North Attleboro, Attleboro and Seekonk, Massachusetts before entering Rhode Island. In Rhode Island, the river flows south through Pawtucket and then into Turner Reservoir/Central Pond in East Providence. Outflow from Turner Reservoir Dam enters the small pond behind Hunts Mill Dam, flows from there to Omega Pond, and then discharges directly into the Seekonk River at tidewater. Primary tributaries of the Ten Mile River are the Bungay and Sevenmile Rivers.

The three dams under study for fish passage are all situated in the city of East Providence and are currently owned by the City.

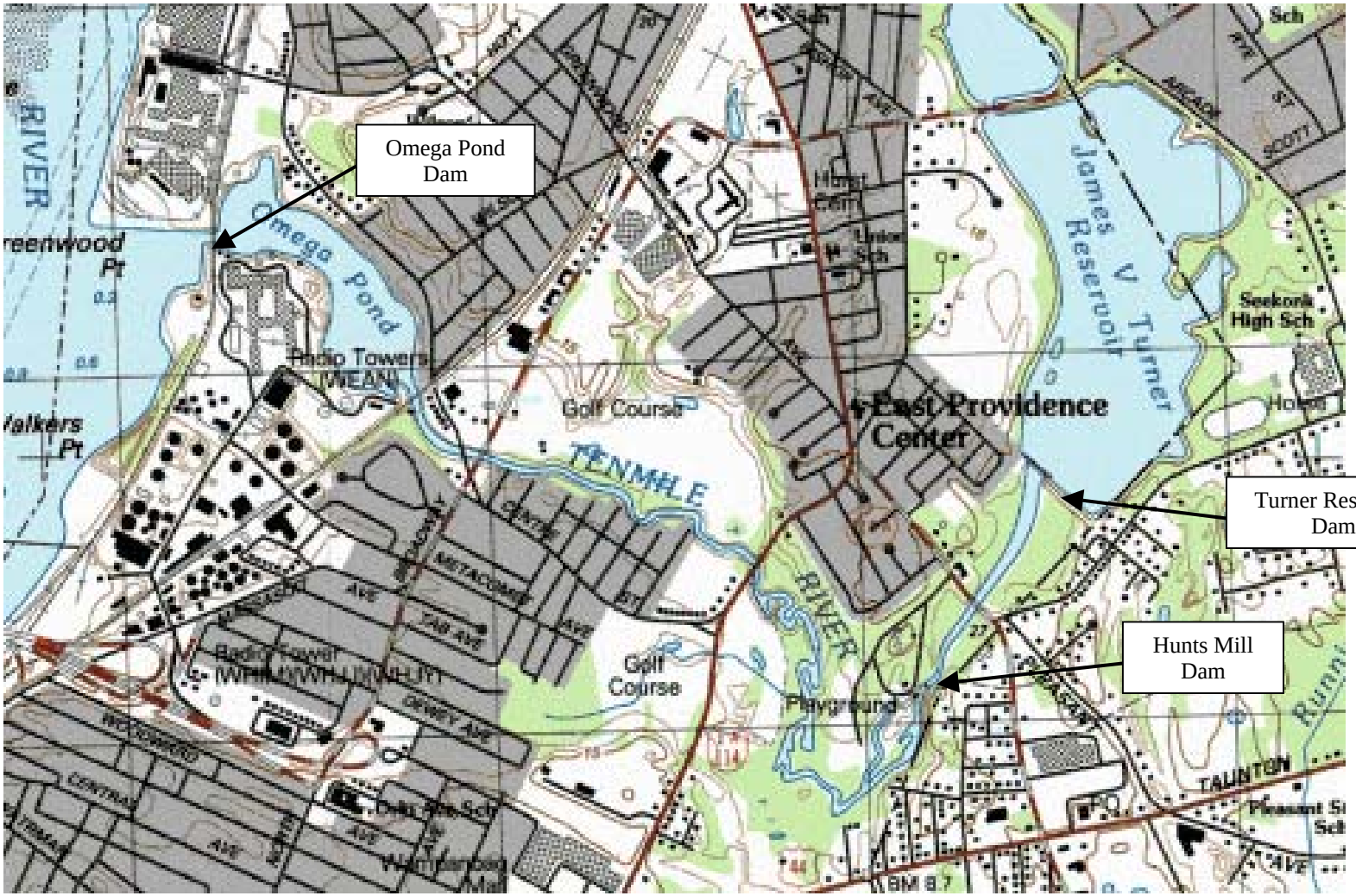
Pertinent Prior Studies and Reports

Strategic Plan for the Restoration of Anadromous Fishes to Rhode Island Coastal Streams – This report, dated December 2002, was prepared by Dennis E. Erkan, Principal Marine Biologist, Rhode Island Department of Environmental Management, Division of Fish and Wildlife. The report identified Rhode Island watersheds with the potential to



Ten Mile River Feasibility Study
Study Area

Figure 1



Ten Mile River Feasibility Study, East Providence, Rhode Island
Anadromous Fish Passage Restoration Sites

Figure 2

restore or enhance anadromous fish populations through upstream passage for migrating adults and downstream passage for juveniles.

Turner Reservoir Study, East Providence, Rhode Island – This Planning Assistance to States report was completed by the New England District, Corps of Engineers in February 2001. The study evaluated the reservoir's potential as a back-up water supply for the city of East Providence and as a recreational area. The preliminary investigation determined that Turner Reservoir and the Central Pond well fields may be suitable for back-up water supply, but would require thorough treatment of the water. Although the water's appearance in some areas is not attractive due to large amounts of aquatic weeds and waterfowl use, the investigation did not find any water quality problems that would prevent recreational use, such as swimming. In addition, the reservoir appears to support a good largemouth bass population that could provide a recreational warmwater fishery.

Rhode Island Ecosystem Restoration Reconnaissance Report, Section 905(b) (WRDA 86) Analysis – This report, completed in July 1999 by the New England District, Corps of Engineers, identified potential ecosystem restoration sites in coastal and riverine areas within the Pawcatuck, Moshassuck, Ten Mile and Woonasquatucket River Watersheds, and the coastline of Narragansett Bay in Rhode Island. Restoring anadromous fish to the lower Ten Mile River was one of the major recommendations of this report.

Ten Mile River Basin, 1997 Water Quality Assessment Report – This assessment was prepared by the Commonwealth of Massachusetts Department of Environmental Protection to provide basic information for focusing resource protection and remediation activities to be executed as part of the watershed management planning process.

Report and Study Process

This Detailed Project Report serves a dual purpose. It provides the basis on which the Chief of Engineers approves a project for construction and also the basis for proceeding to the plans and specifications phase. The main report reflects the planning process, beginning with a description of the ecosystem restoration opportunity, identification of planning objectives and constraints, development and evaluation of alternative solutions, and selection of a recommended plan. Technical and nontechnical information is presented in the main report to support the analysis of alternatives and conclusions recommending Federal participation in an ecosystem restoration project. The Environmental Assessment satisfies the requirements of NEPA, and report appendices provide detailed information that supports both plan formulation and design. The level of detail and extent of engineering work reflected in the technical appendices is sufficient to proceed directly to the preparation of plans and specifications.

SECTION II

PLANNING SETTING AND PROBLEM IDENTIFICATION

General Study Area Setting

Development within the Ten Mile River watershed is varied, with the upper watershed being less developed than the lower watershed. Portions of the upper watershed are over 50 percent forested as compared to the East Providence area that is almost completely developed and has only about 5 percent open land. The river enters the northeast corner of East Providence at Central Pond, flows under Broadway and enters Turner Reservoir. Most of the reservoir is situated in East Providence with a portion of the eastern shore located in the town of Seekonk, Massachusetts. From Turner Reservoir Dam the river flows about one half mile to Hunts Mill Dam and then turns westerly to flow through Omega Pond and enter the Seekonk River.

The river and adjacent open areas have a high recreational value. Walking trails and scenic vistas are present along the western shore of Turner Reservoir, and a city park is located at Hunts Mill Dam. Facilities present at this site include the historic Hunt House, picnic tables, parking and excellent views of the river and the historic dam. Residences line the western shore of Omega Pond and many abutters fish in the pond. The area below Omega Pond Dam is also a popular fishing spot when the herring are running as they attract larger game fish.

Topography and Geology

Ten Mile River elevations range from 250 feet at its headwaters to sea level in East Providence. The river flows through moderately flat terrain along most of its 21-mile length, with much of this area characterized by gently rolling small hills of glacial origin. The highest elevation in the 56 square mile watershed is approximately 450 feet at Red Brush Hill in Plainville, Massachusetts near the headwaters of the river. The city of East Providence is relatively flat as the river gains less than 50 feet in elevation along the 2.5-mile reach from the outflow of Omega Pond Dam to Turner Reservoir.

The Ten Mile River Basin is underlain primarily by sedimentary rock of paleozoic and precambrian origin. The upper section contains igneous and meta-sedimentary rock from the same period. At Hunts Mill and Turner Reservoir Dams, bedrock consists of sandstone with some interbedded shale at the dam at Turner Reservoir. Surficial geology is typified primarily by deposits resulting from the last glacial recession. Bedrock is overlain primarily by sands, gravels and glacial till, and many areas in the immediate vicinity of the river and its tributaries are overlain by flood plain alluvium.

Climatology

The city of East Providence has a cool semi-humid climate typical of New England. Based on Providence data, the mean annual temperature is about 51 degrees. Average annual precipitation in Providence is about 47 inches, distributed uniformly throughout the year. The mean annual snowfall at Providence is about 36 inches. East Providence's location on the Narragansett Bay coastline exposes it to coastal storms that move northeasterly up the Atlantic coast and produce heavy rains, winds and accompanying high tides.

Water Quality

The Ten Mile River has been designated as Class B, Warmwater Fishery, High Quality from the source waters in Plainville, to the Whiting Dam, and Class B, Warmwater Fishery, from the Whiting Dam to the state line by the Massachusetts Department of Environmental Protection (DEP) according to the Massachusetts Surface Water Quality Standards. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

The Rhode Island Department of Environmental Management (RIDEM) Division of Water Resources designated the river as Class B from the Newman Avenue Dam upstream from Turner Reservoir to its outlet on the Seekonk River below Omega Pond. These water quality designations are goals, and do not necessarily mean that a water body is meeting a particular designation. Sections of the Ten Mile River upstream from Turner Reservoir as well as the reservoir itself are on the state of Rhode Island's list of impaired waters (303(d) List), having elevated levels of lead, copper, phosphorus, and coliform bacteria, as well as low dissolved oxygen levels.

A 1999 water quality survey by the Corps of Engineers at Turner Reservoir found elevated levels of nutrients and several metals (zinc, nickel, copper, chromium and cadmium). The survey also included measurements of temperature, pH, conductivity and dissolved oxygen from several locations at various depths. All of the parameters measured were at acceptable levels for survival of most warmwater fish species, as well as other aquatic life. Sources of water quality impairment on the lower Ten Mile River include nutrients from wastewater treatment discharges upstream in Attleboro, and non-point sources such as road runoff and fertilizers from lawns. In addition, some of the sediment contamination is the result of past industrial discharges into the river.

Similar to Turner Reservoir, Omega Pond supports a warmwater fishery indicating that the basic water quality criteria necessary to support aquatic life are being met. During the summer of 2001, temperature, pH, conductivity and dissolved oxygen

levels were measured. The results were generally within acceptable criteria for the survival of most fish species.

With implementation of the Clean Water Act and closing of many industries in the watershed, the river is significantly cleaner now than it was in the 1960's. Additional information concerning water quality is contained in the Environmental Assessment.

Sediment Quality

The sediment samples collected at Turner Reservoir during the summer/fall of 1999 were found to have elevated concentrations of chromium, nickel, copper, zinc, cadmium and lead. The historic industrial discharges upstream from Turner Reservoir as well as the other dams are believed to be the sources of the elevated metals concentrations in the sediments.

Sediments collected in Omega Pond and Hunts Mill Pond by the Corps of Engineers in 2001 also had elevated concentrations of metals as well as other contaminants (see Appendix F). Levels of chromium, nickel, copper, zinc, and cadmium in the sediments of Omega Pond were generally one half of the concentration of the sediment in Turner Reservoir, but they were still above many of the levels where biological effects would occur in the life stages of sensitive aquatic organisms. Lead levels in sediments from Omega Pond were generally higher than those from both Turner Reservoir and Hunts Mill Pond. The absence of additional point or non-point sources of metal contamination downstream from Turner Reservoir indicates that the general reduction in sediment contaminant levels in both Hunts Mill and Omega Ponds could be due to the successive settling out of these materials behind the dams, with most of it settling at Turners, and the remaining settling out in successive downstream areas. The fact that Hunts Mill Pond sediments generally contained the lowest levels of most of the contaminants could be due to it being the lowest head dam of the three thereby providing the least amount of depth for sediment to collect. Most suspended sediments would therefore be carried over the dam and continue downstream to Omega Pond.

Biological Resources

Fish

The Ten-Mile River is designated as Class B, Warmwater Fishery in both Massachusetts and Rhode Island. The numerous ponds and impoundments along the river provide habitat to many warmwater fish species. These include chain pickerel, redfin pickerel, largemouth bass, bluegill, yellow perch and white sucker. The lower section of the river from Turner Reservoir/Central Pond to tidewater at the Seekonk River supports a warmwater fishery. The following paragraphs describe the fishery at each impoundment along this lower section of the river.

Turner Reservoir/Central Pond - Both RIDEM and the Corps of Engineers have conducted fisheries surveys of Turner Reservoir and Central Pond. These surveys indicated the presence of a typical warmwater fish assemblage. Species collected included yellow perch, white perch, largemouth bass, white sucker, bluegill, pumpkinseed, yellow bullhead, golden shiner, American eel, and black crappie. The data from the Corps 1999 fisheries survey of Turner Reservoir indicated that largemouth bass were the most abundant species collected. In addition, the length frequency distribution of these fish indicated the presence of several year classes (including young of year) with some of the larger fish being in the size class of fish that could range from approximately 7 to 10 years old (49 centimeters) in temperate climates (Carlander, 1977, from USACE, 2001). Also, the largemouth bass that were collected had condition factors that were comparable with those from other New England lakes that have healthy largemouth bass populations. This would generally indicate the presence of a suitable food supply to sustain these fish. Although the condition of these fish indicated sufficient forage in the lake, relatively few of the common forage species (such as golden shiner and white sucker) preyed on by largemouth bass were collected. This suggests that the largemouth bass in Turner Reservoir and Central Pond may be relying on species such as young bluegill, pumpkinseed and yellow perch as their primary food source. Therefore, the reestablishment of anadromous alewives and shad would further benefit the ecosystem by providing additional forage for the existing largemouth bass population, as well as other predator species (e.g. black crappie) in the reservoir.

Additional fisheries data were also collected by RIDEM from Turner Reservoir and Central Pond during April of 2001. For Turner Reservoir, the species collected were the same as in the 1999 Corps sampling with the exception of American eel, a single goldfish and two white catfish that were found in the 2001 sampling. In addition, the predominant species caught in 1999 was largemouth bass, whereas in 2001 it was white perch. However, the largemouth bass collected were generally larger than those collected in 1999. This may be due to the fact that the lake was sampled in April before largemouth bass spawning season, and the sample did not have the large numbers of young of year that generally predominate in the summer.

Central Pond was also sampled by RIDEM in April of 2001. Species not previously collected in the past samplings of Turner Reservoir included golden shiner, of which only one representative was collected. The size range for largemouth bass from this sampling was greater including individuals that were smaller, possibly being from the previous summer's young of year. The most abundant species from Central Pond was yellow perch.

Hunts Mill Pond - Fisheries data was also collected from the section of the Ten Mile River between Turner Reservoir and Hunts Mill Dam by RIDEM during August of 2000. Species collected were similar to those that were common to Turner Reservoir, and included bluegill, largemouth bass, white perch, American eel, pumpkinseed, white catfish, golden shiner and yellow bullhead. A warmwater fish assemblage for this area would be expected as the impoundment created by Hunt's Mill Dam extends upstream to the base of Turner Dam.

Omega Pond – The Corps of Engineers sampled Omega Pond for fish on August 29, 2001. A typical warmwater fish assemblage was found that included black crappie, bluegill, golden shiner, largemouth bass, pumpkinseed, yellow perch, and the catadromous American eel. A length frequency distribution of the largemouth bass collected from Omega Pond indicated the presence of several age classes ranging from young of year to 4-9 years old. This distribution indicates that the basic water quality and habitat criteria necessary to support a reproducing population of largemouth bass are being met in Omega Pond. Several juvenile black crappie were also collected from this location indicating that there is natural reproduction of black crappie in either Omega Pond, or upstream in the Ten Mile River.

Vegetation

Major vegetation types within the Ten Mile River watershed include deciduous forest, evergreen forest, scrub-shrub wetland and agricultural fields. Large areas of emergent and aquatic bed wetlands are also situated along the river and its major tributaries, and many impoundments contain large areas of fringing scrub-shrub and emergent wetland vegetation.

Wetland vegetation includes red maple wetlands, and willow, alder, dogwood, witch hazel and sweet pepper bush in scrub-shrub areas. Emergent vegetation closer to the ponds and tributaries includes cattail, sedges, skunk cabbage and pickerel weed. Aquatic bed vegetation present in the various ponds and impoundments include water lily, bladderwort and pondweed.

In the immediate vicinity of the study sites at Omega Pond, Hunts Mill and Turner Reservoir, vegetation types vary as a result of residential and industrial development. Turner Reservoir is bordered by a combination of residential and wooded land, most of it upland, except for large sections of emergent and scrub-shrub wetlands at a large delta area at the upstream end of the reservoir. Predominant emergent vegetation in this delta area consists of cattail with sedges. Surrounding upland in remaining areas of the pond is vegetated with a combination of mixed hardwoods and smaller shrubs. Under-story throughout this area includes abundant stands of poison ivy and sumac. These vegetation types continue through the small pond at Hunts Mill and at Omega Pond. In addition large willows are present in the embankments bordering Omega Pond.

At all three dams, wetland vegetation is limited to small areas along and adjacent to the riverbank. At Turner Dam, the river cascades onto a concrete walled rocky channel, which extends approximately 25 feet downstream from the dam. This precludes the establishment of a large amount of wetland vegetation. A similar situation exists at Hunts Mill Dam, where the downstream channel consists of rocky substrate with naturally occurring bedrock banks that slope down to the river. Only marginal wetland vegetation can be found within the edge of the channel, interspersed with the existing rocky channel. At Omega Pond Dam, the river discharges onto a granite base as it enters tidewater. Two concrete headwalls extend approximately 50 feet from the spillway

channeling the river. These preclude the establishment of significant amounts of estuarine wetland vegetation, although estuarine wetlands are present along the margins of the Seekonk River into which the Ten Mile River flows.

Wildlife

The semi-urban location of the three dams limits the types and numbers of terrestrial wildlife species to those that can exist in close proximity to human population. Species include smaller mammals such as gray squirrel, eastern chipmunk, woodchuck, striped skunk and raccoon. In less populated areas and sections of the upper watershed, mammals can also include muskrat, beaver, river otter, cottontail rabbit, white tailed deer, red fox, gray fox, and coyote.

Turner Reservoir, and to a lesser extent Hunts Mill and Omega Pond, provide habitat to large numbers of waterfowl including mallard ducks, Canada geese as well as domestic ducks, geese and swans. These birds have become extremely prolific in Turner Reservoir, and may be contributing to the less than ideal water quality in some portions of the reservoir.

Reptiles and Amphibians

Reptiles common to the watershed include turtles and snakes, which inhabit many of the freshwater ponds and wetlands as well as some of the wooded upland areas. Turtle species common to the watershed include common snapping turtle, stinkpot turtle, spotted turtle, eastern painted turtle, wood turtle, and eastern box turtle. Snakes common to the watershed include the eastern garter snake, hognose snake, northern water snake, milk snake, northern brown snake, eastern ribbon snake and northern ringneck snake. Most of these are upland species are found in areas adjacent to wetland and aquatic habitats. Amphibian species that can be found in the study area include American toad, spring peeper, grey treefrog, green frog, wood frog, and pickerel frog. Common salamanders that may be found in the watershed include spotted, two lined and redback.

Threatened and Endangered Species

Coordination with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Rhode Island Department of Environmental Management has indicated that no Federally-listed threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service and National Marine Fisheries Service occur in the vicinity of the proposed project, with the exception of occasional transient bald eagles (see coordination letters in Appendix A).

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation Management Act strengthen the ability of the National Marine Fisheries Service and the New England Fishery Management Council to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat", and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The estuarine and marine areas downstream of the Ten Mile River (i.e. the Seekonk and Providence River estuaries) provide Essential Fish Habitat for adults and juvenile life stages of winter flounder, summer flounder, windowpane flounder, bluefish, scup, Atlantic mackerel, black seabass, king mackerel, and Spanish mackerel.

Historic and Archaeological Resources

The federation of the Wampanoag Indians occupied the land area east of the Seekonk River, which includes the lower Ten Mile River watershed. In the 1670's, the area inhabited by the Wampanoag stretched from Pawtucket on the north, to Cape Cod on the east, and south to Newport. Villages were typically small, seasonal campsites that were situated near bodies of water for most of the year, and moved inland during the winter.

The first settlement of East Providence by Europeans was in 1636 when Roger Williams and his followers founded a new community called "Seacunke" (Seekonk) along the shore of a cove that is today Omega Pond northwest of the current project location. Several months later, Williams and his entourage relocated nearby to what would become the city of Providence. In 1643, Puritans purchased a tract of land from Massasoit, chief of the Wampanoags, which encompassed the communities of Rehoboth and Seekonk, Massachusetts, most of East Providence, and portions of Pawtucket. In 1645 the township's name was changed from Seacunke to Rehoboth.

Agriculture was the main subsistence practice in the early years of the settlement through to the mid-20th Century. Gristmills were constructed along the Ten Mile River shortly after settlement. Richard Wright, a prominent member of the early community, erected the first mill at the mouth of the Ten Mill River. Shortly thereafter, a second mill was constructed further up the river at what is now Hunts Mill. No traces of buildings from the initial period of settlement remain.

The study area is located within the bounds of the Rumford Historic District (Rhode Island Historical Preservation Commission 1976). This district contains the largest concentration of 18th and early 19th Century buildings in the city. Among the notable buildings are the John Hunt house on Hunts Mill Road, a circa 1770, 2-story, 5-bay Georgian dwelling with center chimney and gable roof (listed on the National Register of Historic Places), and an 1893 pumping station built by the East Providence Fire District consisting of a 1-story stone building with hip roof and large rear stack. The

National Register nomination form for the Rumford Historic District describes the buildings and surrounding grounds at Hunts Mill as "a property of special significance…closely associated with local industrial history and recreational activity [serving] as a mill privilege, amusement park, and waterworks from the seventeenth century until the early 1970's." The Hunts Mill Dam, although modified since its original construction, would be considered a contributing element to the district as a component of the Hunts Mill built environment. The current dam dates from 1849-50 and was likely associated with the establishment of the Rumford Chemical Works.

Mills have occupied the site of the Hunt House since the late 17th Century. The Hunt family, among the earliest settlers of Rehoboth, MA purchased a gristmill and fulling mill here in 1713. In 1873, the Rumford Chemical Company purchased Hunts Mill. By 1893, the last of the mill buildings were demolished and the 1893 pumping station built to supply water to the Rumford Company and to the new factories in Phillipsdale north of the present study area.

Hunts Mill became a prime recreation area and in 1900, a carousel, picnic grounds, and dance hall were constructed and comprised the Hunts Mill Amusement Park. The Ten Mile River was dotted with canoe houses and refreshment stands all the way to Omega Pond. In 1925 the dance hall burned down and the amusement park was closed forever. In 1928, the town of East Providence took over the water company and families that operated the company used the Hunt House. In 1936 the Hunt House became the offices for the East Providence Water Department until the mid-1980's when the water department moved to new offices. The city of East Providence owns the Hunts Mill area including the Hunt House and adjacent Caleb Williams House. Since 1989, the East Providence Historical Society has been restoring the house to its original appearance and operating it as a museum.

The river was dammed at Omega Pond during the early 20th Century to create an industrial water supply. Conversely, Turner Reservoir was created as a drinking water supply for the city of East Providence. The dam at this site dates from about 1930. Turner Reservoir is no longer used as a back-up water supply for East Providence.

Cultural, Economic and Recreational Resources

The city of East Providence had a population of 48,688 people in 2000, ranking it fifth among Rhode Islands 39 cities and towns. With a land area of 13.41 square miles, this results in a population density of 3,632 persons per square mile. The City also contains 3.21 square miles of water surface area. Major employers in 2000 were educational, health and social services (21.1 percent), manufacturing (19.4 percent), and retail trade (11.7 percent). A significant number of people are also employed in the professional, scientific and technical areas, and the health care, administrative and retail service areas.

The Ten Mile River is a major feature of the City, initially flowing southerly along the eastern border of the City and then flowing westerly through the City to the Seekonk River. Along its course it provides significant recreational and cultural resources for the city. Turner Reservoir/Central Pond is used heavily for recreation, including non-powered boating, canoeing, recreational fishing, hiking and bird watching. A trail on the west side of the reservoir provides access to less developed areas adjacent to the impoundment. Access to the spillway area at Turner Dam is restricted due to safety concerns associated with the height of the abutment walls and spillway. The area surrounding Hunts Mill Dam includes a well-used park that provides areas for picnicking, walking and other forms of passive recreation. The restored John Hunt House containing the Museum of East Providence History is also located near the dam. Omega Pond is used for recreational fishing and non-power boating, as well as passive recreation. All sites provide scenic natural vistas that are welcome within this highly developed community.

Expected Future Conditions Without a Project

If anadromous fish passage is not restored at the three dams along the lower Ten Mile River, a prime spawning and nursery habitat will remain seriously underutilized. The remnant river herring population that is currently being netted over Omega Dam by volunteers would be the only way that anadromous river herring would be able to spawn in Omega Pond and the section of the Ten Mile River below Hunts Mill Dam. The section of river upstream of Hunts Mill Dam and the 297 acres of lacustrine habitat in Turner Reservoir would be inaccessible to these river herring. In addition, as netting herring over Omega Pond Dam is very time consuming, the number of herring that can be lifted over the dam is limited. Therefore, without a project, a self-sustaining population of anadromous river herring could not be established in the Ten Mile River upstream from Omega Pond and no American shad would enter the river. In addition, the ecological benefits associated with restoring these fish to the river would not be realized.

SECTION III

PLAN FORMULATION

This section describes the plan evaluation and selection process. Formulation of a plan to restore anadromous fish to the lower Ten Mile River involved the following steps:

- Identification of Objectives
- Formulation of Alternative Plans
- Evaluation of Alternative Plans
- Selection of a Recommended Environmental Restoration Plan

Each of these steps is discussed below. Plan formulation and selection of the recommended plan was thoroughly coordinated with the interested public, local and state officials and resource agencies.

Identification of Restoration Objectives

The primary ecosystem restoration objective of the study is to restore anadromous fish passage at the lowest three dams on the Ten Mile River. As approximately 90 percent of the suitable anadromous fish spawning habitat is located upstream from the third dam (Turner Reservoir Dam), the expressed goal of the state of Rhode Island, city of East Providence and Save the Bay, Inc. is to restore passage at all three dams. Based on the available habitat in this portion of the river, the target restoration species are blueback herring, alewives and American shad.

Formulation and Evaluation of Alternatives

At each dam location, three alternatives were identified for evaluation. These are: no action, dam removal and providing fish passage at the existing structure. Each of these alternatives is evaluated below.

No Action

In the no action alternative, limited use of the habitat below Hunts Mill Dam would continue as it is expected that volunteers would continue to net herring over Omega Pond Dam. Habitat areas upstream of Hunts Mill Dam, which represent the majority of available habitat, would not be utilized. Under this alternative, a self-sustaining population of river herring would not be established in the Ten Mile River upstream from Omega Pond. Other species, such as American shad and Atlantic salmon, would also be denied access to spawning and habitat areas.

Dam Removal

In this alternative, one or more of the three dams that are currently blocking upstream migration of anadromous fish would be removed. The habitat would change from lacustrine (impounded lakes) to riverine as the impoundments drain and the river is restored to free flowing. Removal of each dam is discussed in the following paragraphs.

Omega Pond Dam - Removing Omega Pond Dam would relocate the head of tide about 2500 upstream to a point near the Conrail railroad bridge. The pond would revert back to a salt marsh that would be under both tidal and freshwater influence. The former Omega Pond would become repopulated with estuarine species, and anadromous fish would have access to this area and an additional 2 miles of riverine habitat up to Hunts Mill dam. Removal of the dam would cause a large amount of sediment to be naturally flushed downstream into the Seekonk River estuary, unless it was removed prior to dam removal. To assess the impact that this would cause, seven sediment samples were collected and analyzed (see Appendix E). This testing determined that there are elevated levels of arsenic as well as other potential contaminants in the sediment. Allowing these sediments to naturally flush into the estuary would not be acceptable and these sediments would need to be removed and disposed of in a suitable landfill. This would substantially increase the cost of dam removal. Many of the abutters to Omega Pond are opposed to dam removal due to the loss of the impoundment and the benefits it offers (scenic views and a stable environment). Based on the above impacts, the state of Rhode Island, city of East Providence and Save the Bay, Inc. have eliminated the option of removing Omega Pond Dam as a potential alternative for restoring fish passage.

Hunts Mill Dam – Removal of Hunts Mill Dam would eliminate the small impoundment behind the dam and open up an additional half-mile of riverine habitat upstream to Turner Reservoir. The habitat immediately upstream from the dam would change from lacustrine to riverine, exposing the former riverbed containing rock and gravel, with associated pools and riffles. Sediments behind the dam are relatively shallow and less contaminated than those at Omega Pond (see Appendix E). However, removal by dredging would be preferable to allowing them to naturally disperse downstream and impact water quality and habitat.

Hunts Mill Dam and abutting historic structures are on the National Register of Historic Places, and the existing Hunt House serves as a public museum. In addition, the city of East Providence (the current owner of the dam and property) has created a public park/recreation area at this location, with the curved spillway, associated waterfalls, and the small impoundment serving as aesthetic resources. There are also plans to make additional improvements at the site, with the intention of enhancing and maintaining the dam as an historic landmark. Based primarily on historic concerns, the state of Rhode Island (Historical Preservation and Heritage Commission), and the city of East Providence have eliminated removing the dam as a potential alternative for restoring fish passage.

Turner Reservoir Dam – Removing Turner Reservoir Dam would transform the 297-acre Turner Reservoir/Central Pond to about two miles of historic riverine habitat and adjacent riparian areas. This would allow free passage for up-migrating river herring and shad to the new habitat area within the former impoundment, plus an additional mile of existing riverine habitat upstream from Central Pond. Similar to the two other downstream dams noted above, a large amount of sediment has accumulated behind the Turner Reservoir Dam. This sediment has been tested, and found to contain elevated levels of several metals, including cadmium, lead, copper and zinc. Many of these metals are at levels above those where biological effects would be expected to occur in sensitive aquatic life. Therefore, it would be necessary to dredge this sediment and dispose of it in an appropriate disposal site prior to dam removal to prevent it from contaminating downstream areas of the Ten Mile River. This would increase the cost of the proposed fish passage project beyond the scope of the available resources to implement it. The Turner Reservoir/Central Pond complex is also a significant recreational resource and a back up water supply for the city of East Providence. The reservoir is heavily used by recreational fishers and boaters, and a moderately used walking trail runs along the East Providence side of the impoundment. Dam removal would eliminate this resource. Based on the above cost and societal impacts, the State and the City have eliminated the removal of Turner Reservoir Dam as a viable fish passage alternative.

Construction of Fishways

In this alternative, concrete Denil fishways would be constructed at each of the three dams. This would open up a riverine migratory corridor extending approximately three miles from Omega Pond Dam to Turner Reservoir, and an additional mile from Turner Reservoir/Central Pond to the Golf Club Dam in Pawtucket, Rhode Island. In addition, anadromous alewives, which spawn in slower moving waters of rivers, and in lakes and ponds, would have unimpeded access to approximately 340 acres of lake spawning habitat in Omega Pond, Hunts Mill Pond, and Turner Reservoir. As anadromous fish returns to the Ten Mile River are likely to exceed available spawning grounds, a fish trap is included at Hunts Mill Dam to relocate excess fish to other coastal watersheds. This supports Rhode Island's strategic plan for the restoration of anadromous fishes to coastal streams.

Omega Pond Dam - In this alternative, a 4-foot wide concrete Denil fishway would be constructed adjacent to the left abutment of the spillway to provide upstream fish passage (see Plate 1). The entrance channel to the fishway would be 30-inches wide and be situated at the base of the spillway at a 45-degree angle to the direction of flow. The fishway would then widen to 4 feet as it turns 135 degrees. After a 10-foot level section, the fishway would ascend parallel to the spillway/bridge abutment for a length of 42.5 feet. At the top of this lower leg of the fishway, the fishway turns 180 degrees at a 10-foot long turning/resting pool. From this point, the fishway would ascend along an additional 57.5 feet to an 8.5-foot long exit channel into Omega Pond. The exit channel would be cut into the existing stone spillway. For downstream passage, a 3-foot wide by 1-foot deep downstream migrant slot would be cut into the spillway about 20 feet from the left abutment. Due to the stepped downstream face of the spillway, a smooth surface

flume and plunge pool would also be included to provide safe downstream passage for juveniles.

With the proposed fish ladder, up-migrating fish would be allowed free access to areas upstream of Omega Dam, which includes the approximately 2 miles of riverine habitat upstream from Omega Pond as well as the 33 acres of lacustrine habitat in Omega Pond. During periods of upstream migration, Denil baffles would be installed and water would be allowed to flow through the fishway by opening the stop log control structures at each end of the fishway. This would enable fish to migrate through the fishway. A fishway of this size could potentially pass between 250,000 and 400,000 river herring and about 25,000 shad.

Hunts Mill Dam - For this alternative, a similar Denil fishway would be constructed adjacent to the right end of the dam, and include a fish trap (see Plate 4). The exit channel of this concrete fishway and fish trap would fit into the existing headworks structure adjacent to the right end of the concrete spillway. The remainder of the fishway would continue past this structure along the right bank and then turn back to its entrance at the base of the spillway. Specific features include a 30-inch entrance channel that widens from 30-inches to 4 feet and turns 135 degrees before it ascends 35 feet parallel to the riverbank. The fishway then turns 180 degrees at a 10-foot turning/resting pool, and ascends an additional 32.5 feet before entering a 10-foot level section. This is followed by an 8-foot wide by 10-foot long fish trap with lifting brails to facilitate the transfer of fish. The exit channel from the fish trap would be 3 feet wide. The fish ladder would allow anadromous river herring and shad access to an additional 10 acres (0.5 river miles) of lacustrine spawning and nursery habitat in Hunts Mill Pond, extending to the base of Turner Reservoir Dam. The fishway ladder would be operated in a similar fashion as the one proposed at Omega Pond Dam, and during the same time period. This would allow up-migrating river herring and shad to continue their migration to the base of Turner Reservoir Dam. A downstream migrant slot is not required at Hunts Mill Dam because the shape and irregularities of the existing spillway will provide sufficient water depth for downstream passage.

Turner Reservoir Dam - Upstream passage would be provided by a 4-foot wide concrete Denil fishway that would be placed adjacent to the left abutment of the concrete spillway (see Plate 8). The entrance to the fishway would be situated in the stilling basin at the base of the spillway. As the inlet faces downstream at a 45-degree angle, the fishway makes a 135-degree turn before ascending 47.5 feet to a 10-foot turning pool. The upper sloping leg of the fishway is 60 feet long and terminates at an exit channel about 11 feet long. This exit channel would be cut into the spillway about 2.1 feet. During periods of upstream migration, the fishway would be operated concurrently with the fishways at Hunts Mill and Omega Pond. Downstream passage would be provided via a 3-foot wide by one-foot deep notch in the spillway. This notch would be situated about 19 feet from the left spillway abutment.

Construction of a fishway at Turner Reservoir will enable up-migrating anadromous fish on the Ten Mile River to continue their migration from areas above the

lower two dams to expansive spawning areas above this dam. This includes approximately 297 acres of lacustrine spawning habitat within Turner Reservoir for anadromous alewives, and about a mile of riverine habitat upstream from the reservoir.

The Rhode Island Department of Environmental Management has estimated that providing anadromous fish passage at the lower three dams on the Ten Mile River would support a run size of about 205,000 river herring.

Other Fish Passage Alternatives

Another alternative method of fish passage would be the installation of fish lifts at the dams. The primary disadvantage of a fish lift is that it requires manual operation as compared to Denil fishways that passively allow fish to migrate after the fishway is put into operation. Most fish lifts are operated periodically during the day, and rarely at night. This requires up-migrating fish to wait at the lift gates until they are opened for transport. This creates less than optimal conditions as fish can become crowded during the waiting period. This can result in increased predation, temporary reduction in dissolved oxygen levels in the waiting area, aggressive behavior (fin nipping) due to crowding, and scale abrasion. These stress conditions can have long term effects by lowering the fish's resistance to disease or generally weakening the fish. Although crowding may not be significant during most transport operations, the fact that crowding is inherent in fish lift operations is a disadvantage when compared to a fishway that allows unobstructed upstream movement. Another major disadvantage is the high cost associated with operating and maintaining fish lifts.

Selection of an Anadromous Fish Restoration Plan

Selection of a fish restoration plan for the lower Ten Mile River involved the evaluation of fish passage efficiency, public input, existing uses and historic resource concerns. Fishway alternatives such as Denil fishways are generally 70%-90% efficient at passing shad and river herring when compared to having no dam in place. Consequently, fishways would be less effective than complete dam removal, which would allow unobstructed upstream and downstream fish migration. Dam removal would also provide benefits associated with restoration of the historic riverine habitat. Construction of fishways, in comparison, would retain the existing lacustrine habitat and associated warmwater fishery, as well as the extensive riparian and wetland areas that surround the existing impoundments. The municipal and recreational resources associated with these impoundments, particularly at Turner Reservoir, would also be maintained. As previously stated, Turner Reservoir/Central Pond is heavily used by recreational fishers and boaters, for hiking and walking along the periphery, and is a back up water supply. At Hunts Mill Dam, the historic significance of the dam and extensive recreational use reduce the net benefits of removal. Removal would also require upland disposal of the large amount of contaminated sediment that has accumulated behind these dams. Because of the high cost of removal and the loss of substantial values provided by

these dams and impoundments, dam removal is not the recommended option to restore fish passage to the lower Ten Mile River.

In summary, as the no action alternative would not meet the goals of the study, and dam removal is not acceptable due to high cost, impoundment uses, public opposition, and historic significance, providing fish passage via a Denil fishway at each of the three dams is the recommended plan.

SECTION IV

DESCRIPTION OF RECOMMENDED PLAN

Plan Features

The recommended plan consists of providing a Denil fishway at Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam. Each fishway would be 4 feet wide and have a 1 vertical on 8 horizontal floor slope to allow the passage of both river herring (blueback herring and alewives) and American shad. The fishway consists of the following major features:

- Entrance channel – The entrance channel is flat and located as close as possible to the base of the dam. It is designed so that at minimum operating flows, there is two feet of water in the channel. It is also designed so that the attraction jet of water exiting the fishway is stronger than any other flow vectors so that migrating fish can easily locate the entrance.

- Denil baffle section – At the upstream end of the entrance channel, the Denil baffle section begins. The concrete floor is now sloped, with the slope varying to suit the target fish. In this case, American shad are relatively weak swimmers so the slope is 1 vertical on 8 horizontal. Baffles are placed along this sloped section every 30-inches at a 45-degree angle. For the 4-foot wide Denil, the clear opening between the sides of the baffle is 28 inches. A second Denil section will be required at each dam due to the height of each dam. A turning section is provided at the top of the first baffle section to allow the fish a rest before moving upstream again.

- Exit channel – The uppermost Denil section terminates at a level exit channel that is cut into the existing spillway. The width of the fishway at this point remains at 4 feet. The channel is designed to have a minimum of 2 feet of water depth at minimum pool operating levels.

- A downstream migrant slot would also be notched into the spillway at Turner Reservoir and Omega Pond dams. This slot will be 3 feet wide by 1 foot deep and would facilitate downstream movement of juveniles. A migrant slot is not required at Hunts Mill Dam as the shape and irregularities of the existing spillway will provide sufficient water depth for downstream passage.

These features are shown on Plates 1 through 10.

The following table lists the entrance channel, turning pool and exit channel elevations of each fishway.

Table 1: Fishway Design Elevations (feet NAVD 88)

Location	Entrance Channel	Turning Pool	Exit Channel
Omega Pond Dam	-4.35	0.96	8.15
Hunts Mill Dam	23.36	27.74	31.80
Turner Reservoir Dam	32.00	37.95	45.45

Design Considerations

The following summarizes the design considerations developed for major project features. Additional surveys, and detailed structural and mechanical design will be accomplished as required during the plans and specifications phase to complete design of these features.

The proposed fishways will not derive structural support from existing spillways, abutments or other features of the dams. Each fishway has been designed based on foundation conditions at the site. At Omega Pond Dam, bedrock is deep and the structure will be supported on cast-in-place concrete caissons placed 34 feet into the streambed. Since bedrock is fairly close to the surface at Hunts Mill Dam, this structure will be supported by footings placed directly on bedrock. At Turner Reservoir Dam, cast-in-place caissons drilled 5 feet into bedrock will support the fishway. Based on the depth to bedrock, the total depth of these caissons will be about 35 feet.

Installation of fishways at the three dams will have no impact on current operations as all dams are currently operated as run-of-river dams where inflow effectively equals outflow. In addition, based on an assessment at each dam, the Denil fishways and appurtenant structures are considered to have no net impact on flood elevations upstream or downstream of the dams (see Appendix B).

As currently proposed, construction activities at Hunts Mill Dam will include removal of several existing structures. These include a reinforced concrete pipe that penetrates the dam and runs along the west bank of the river and a concrete cistern like structure that this pipe enters below the dam. These structures are in poor condition and should be removed to construct the fishway.

Construction Considerations

Construction would require a moderately sized work force with varied construction skills, largely in the heavy equipment, and semi-skilled and skilled labor

trades. Within the Providence area there are a sufficient number of workers that could commute to work and not require housing in the project area. Since the Hunts Mill Dam project area is open to the public, maximizing safety will be a major concern. Entrance to the Omega Dam and Turner Reservoir Dam sites is partially controlled by existing fences, but construction site safety will also need to be addressed at these locations. Access to the staging areas identified in this report will also need to be controlled.

The control of water will be a major consideration during construction of the fishways. It is anticipated that the majority of water will be controlled by the use of portable dams or cofferdams. Construction of the fishway at Omega Dam will require the use of low-head drilling/caisson equipment for work beneath the railroad bridge, and may require the construction of a temporary access road. Construction at Omega pond will require coordination with the railroad for such items as flagmen, restricted construction hours, equipment restrictions, and other items.

Operation, Maintenance, Repair, Replacement and Rehabilitation Requirements

Operation and maintenance of the project can be divided into two major categories: (1) operation of the fishway during fish migration periods; and (2) periodic inspection and maintenance of the fishway to ensure effective operation as required. These activities will include installation and removal of baffles and stoplogs as required, periodic cleaning of the facility, monitoring during fish migration, and maintaining records concerning the numbers of fish that transit the fishway.

Repair, replacement and rehabilitation of all project features will be the responsibility of the non-Federal sponsors. Repair entails those activities of a routine nature that maintain the project in a well-kept nature: replacement includes activities taken to replace worn-out project elements or portions thereof; and rehabilitation includes activities necessary to bring a deteriorated project back to its original condition. Since major project features are expected to last for the 50-year project life, repair, replacement and rehabilitation costs should not be significant.

Summary of Plan Costs, Accomplishments, Benefits and Impacts

Project Costs

Total Project Costs - Total project costs of the recommended plan are shown in Table 2. These costs, totaling $1,900,000, include direct construction costs with escalation; contingencies of 25 percent; preparation of plans and specifications; construction management; and real estate acquisition. A detailed breakdown of construction costs at each dam is included in Appendix C.

Table 2
Total Project Costs
(05/2004 Price Levels With Escalation)

Work Items	Cost
Construction Cost of Fishways	$1,400,000
Prepare Plans and Specifications	300,000
Construction Management	150,000
Real Estate Cost	50,000
Total Cost	$1,900,000

Apportionment of Costs – Costs for environmental restoration projects are shared 65 percent Federal and 35 percent non-Federal. The apportionment is, therefore, $1,235,000 Federal and $665,000 non-Federal.

Operation, Maintenance, Repair, Replacement and Rehabilitation Costs - Estimated operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs include operating the structures to allow fish passage, maintaining the structure and all appurtenances (baffles, stop logs, etc.), periodic cleaning, and maintenance of records concerning fish that transit the fishway.

The average annual cost of the above maintenance items is estimated at approximately $25,000 for monitoring and control during fish migration, periodic maintenance and cleaning, and oversight of the fish migration program for the lower Ten Mile River. Since major rehabilitation of the fishway is not expected during its 50-year project life, an additional $3,000 per year has been added for miscellaneous repair to project features, particularly those at the fish trap at Hunts Mill dam. Total OMRR&R costs are therefore approximately $28,000 annually. Under existing regulations, these costs would be a non-Federal responsibility.

Plan Accomplishments and Benefits

The recommended plan to construct Denil fishways at Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam will restore anadromous fish populations to the lower Ten Mile River up to the Golf Club Dam in Pawtucket, Rhode Island. This would allow anadromous alewives access to about 340 acres of spawning habitat within Omega Pond, Hunts Mill Pond and Turner Reservoir/Central Pond, and approximately three miles of riverine spawning habitat for blueback herring and American shad. Based on projections by the Rhode Island Department of Environmental Management, these habitat areas will support a fish run of over 200,000 herring. The number of American shad that will return is unknown, but the fishways are capable of passing about 25,000 shad.

Additional benefits to the ecosystem would also be incurred by the provision of fish passage on the Ten Mile River. A fishway on the Westfield River in Massachusetts

(a tributary to the Connecticut) has passed, in addition to the species noted above, American eel, white sucker, largemouth bass, smallmouth bass, brook trout, brown trout, rainbow trout, carp and striped bass (Slater, 2001). These fish have been observed using the fishway for spawning and/or seasonal migrations (e.g. during high temperatures and lower flows, many salmonid species will seek refuge in colder water tributaries upstream from a larger river). It is presumed that similar usage may occur in the Ten Mile River, since fish from one impoundment will be able to move upstream beyond Turner Reservoir/Central Pond.

Other ecological benefits include the increase in productivity associated with the re-establishment of anadromous fishes to their historical habitat. If shad and blueback herring become established in this river, the out-migrating juveniles would provide forage not only for resident warmwater species in the Ten Mile River (including the impoundments of Turner Reservoir and Omega Pond) but for marine and estuarine fish in the Seekonk and Providence Rivers downstream from Omega Pond. In addition, returning adults would provide forage for larger fish in Narragansett Bay and other marine waters. These fish would include striped bass, which move into the areas around the same time as many of the returning alosid species, as well as many federally managed species inhabiting the area. The overall benefits would not only be to an ecosystem, but for anadromous fish, which by definition (ER 1105-2-200) are a federally significant resource. Therefore, the project outputs are in the federal interest.

Providing fish passage at the three dams is also in accordance with the overall Coastal America cooperative effort to restore anadromous fish to the Northeast, as well as the restoration plans of various other state and local government agencies. Objective 3.2 of Goal 3 in the Ten Mile River Draft Five Year Watershed Action Plan (2002-2006) (prepared by the Commonwealth of Massachusetts Executive Office of Environmental Affairs, Ten Mile River Watershed Team Action Planning Subcommittee) is to "create physical characteristics to fully support aquatic life." This includes those characteristics necessary to restore anadromous fish to their historical habitat.

Adverse Environmental and Other Impacts

The proposed installation of fishways at Turner Reservoir Dam, Hunts Mill Dam, and Omega Pond Dam, is not expected to have any long-term adverse effects on the existing environment of the Ten Mile River and the associated impoundments. Each fishway will allow anadromous fish to access spawning habitat in sections of the Ten Mile River and impoundments upstream from each of the respective dams. The construction of fishways at these three dams is expected to have a positive effect on the overall ecosystem of the Ten Mile River as well as the city of East Providence. The most substantial effect will be the contribution to estuarine and marine food webs from fish spawned in the Ten Mile River. The passage of anadromous fish at these dams will also provide an additional recreational opportunity where visitors will be able to observe the upstream migration of anadromous fish. Installation of interpretive signs would further explain the purpose and need for the fishways.

The construction of three fishways on the Ten Mile River at Turner Reservoir Dam, Hunts Mill Dam and Omega Pond Dam, is not expected to have any long-term negative effect on the existing vegetation, wildlife, amphibians or reptiles in the project area.

The construction of a fish ladder at each of the three dams, Turner's Reservoir, Hunts Mill Dam and Omega Pond Dam, is not expected to have any significant long-term negative effect on the overall hydrology of the Ten Mile River in these locations. The fishways will notch into the existing spillways of the dams, and will not alter the existing pool levels. An analysis of the structures and their function (see Appendix B) also determined that they would not impact peak flood water surface elevations.

The proposed project is not expected to have any long-term negative effects on the water quality of the Ten Mile River in the vicinity of and downstream from the three dams. Fish ladder construction will involve the temporary construction of a cofferdam at each construction location in order to conduct the work in the dry, and minimize any potential negative effects to water quality. The resulting flow configuration of the fish ladders may actually improve water quality in the immediate vicinity of the fish ladders and downstream by providing additional aeration as the water flows through the baffles of the Denil fishway.

The proposed construction of fish ladders at the three dams on the Ten Mile River will not involve significant disturbance of the existing sediments either downstream or upstream from the construction area, and it is not anticipated that the project will cause any significant sediment releases into the Ten Mile River.

The construction of fish ladders at Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam is not expected to have any long-term negative effects on the aquatic and/or wetland vegetation in the vicinity of the project footprint(s).

The historic significance of Hunts Mill Dam and the surrounding area will require an intensive archaeological investigation of the riverbank area that would be disturbed for the fishway structure. This will be accomplished prior to construction. Further consultation during the Plans and Specifications phase of the project will lead to the preparation of a Memorandum of Agreement (MOA) between the Corps, the RI State Historic Preservation Office (SHPO), the East Providence Historic Properties Commission, other interested parties, and potentially, the Advisory Council on Historic Preservation (ACHP).

The project will have no long-term impacts on air quality. During construction, equipment operating on the site will emit pollutants including nitrogen oxides that can lead to the formation of ozone. The Rhode Island State Implementation Plan has no permit requirements for construction projects. Therefore, this project conforms to the Clean Air Act, Rhode Island State Implementation Plan. In order to minimize air quality effects during construction, construction activities will comply with applicable provisions

of the Rhode Island Air Quality Control Regulations pertaining to dust, odors, construction, noise, and motor vehicle emissions.

Regulatory Requirements

The following permits are required for project construction:

- Water quality certification from RIDEM pursuant to Section 401 of the Clean Water Act
- CZM consistency determination from the RI Coastal Resources Management Council pursuant to the Coastal Zone Management Act
- RIDEM stormwater permit
- Section 404(b)(1) evaluation, provided as an attachment to the EA

Real Estate

The Rhode Island Department of Environmental Management (RIDEM) is the non-Federal sponsor and is responsible for providing all lands, easements, rights-of-way and disposal areas needed for project construction. The proposed construction activities will require temporary and permanent easements for construction, and access for operation and maintenance of the completed project. For planning purposes, the Real Estate Report (Appendix F) estimated that total real estate costs would be $50,000.

Financial Analysis

The non-Federal sponsor, the Rhode Island Department of Environmental Management (RIDEM), has indicated its willingness to execute a Project Cooperation Agreement (PCA) for this project. RIDEM has partnered with the New England District on environmental restoration projects that are now complete. Accordingly, RIDEM is aware of its obligations to implement this project and is able to meet its financial obligations.

View of the Sponsor

The non-Federal sponsor, the Rhode Island Department of Environmental Management (RIDEM), is committed to improvement and restoration of habitat in Narragansett Bay and coastal watersheds. The recommendation to restore anadromous fish to the lower Ten Mile River represents an important opportunity to further that objective. RIDEM desires to participate in this restoration project, which is also strongly supported by the city of East Providence and Save the Bay, Inc.

Implementation Schedule

Implementation of the recommended plan is subject to the Corps of Engineer's review, approval and funding processes, and sponsor participation, including execution of a Project Cooperation Agreement (PCA). Upon receiving approval from the Corps North Atlantic Division, the New England District will prepare plans and specifications prior to solicitation of construction bids and contract award. Subject to the availability of funds, construction of the restoration project could begin as soon as the spring of 2006.

SECTION V

SUMMARY OF STUDY COORDINATION

Coordination efforts have been ongoing since completion of the Rhode Island Ecosystem Restoration Report, Section 905(b), WRDA 86 Analysis, in July 1999. Restoring anadromous fish to the Ten Mile River was a major recommendation of this report and a Feasibility Cost Sharing Agreement for this study was executed in March 2001.

Efforts to restore anadromous fish to the Ten Mile River have broad support as evidenced by the study cost sharing partners. Funds and support have been provided by the Rhode Island Department of Environmental Management, the city of East Providence through an Aqua Fund Grant, and Save the Bay, Inc., a non-profit group whose mission is to ensure that the environmental quality of Narragansett Bay and its watershed is restored and protected. These agencies have been very active during the study process. To obtain the maximum coordination and cooperation with and between interested agencies and individuals, coordination meetings were held periodically during the study period. The following is a list of agencies and groups that participated in coordination meetings held during the study:

Federal Agencies
- U. S. Fish and Wildlife Service
- U. S. Environmental Protection Agency
- National Marine Fisheries Service

State of Rhode Island
- Department of Environmental Management
- Historical Preservation and Heritage Commission
- Division of Fish and Wildlife

City of East Providence
- Planning Department
- City Engineer
- Parks and Recreation Department
- Historical Properties Commission

Non-Governmental Organizations
- Save the Bay, Inc.

The study was coordinated with Federal and state fish and wildlife resource agencies to obtain design criteria and their comments. The US Fish and Wildlife Service provided alternative fishway designs, and participated in numerous meetings with the RI Division of Fish and Wildlife and other State and local officials. This coordination included meetings to discuss alternative designs and plans, and plan selection.

State and local officials, and Save the Bay, Inc. have been very involved in the study through participation at coordination and working group meetings. Significant meetings during the study process include the following:

- April 25, 2001 – Press event at Hunts Mill Dam to announce initiation of the Ten Mile River fisheries restoration study.

- May 1, 2002 – Site visit with State legislators and City councilors.

- January 21, 2003 – Meeting with Save the Bay, Inc, and the East Providence Conservation Commission to discuss fishway designs.

- March 18, 2003 – Meeting with the East Providence City Council to present the status of the study and the proposed fishway designs.

- April 24, 2003 – Meeting with the Rhode Island SHPO, and the East Providence Historical Properties Commission and the Department of Planning and Economic Development at Hunts Mill Dam to discuss the fishway design.

- October 22, 2003 – Meeting with USFWS, Rhode Island SHPO, and the East Providence Historical Properties Commission and the Department of Planning and Economic Development to finalize the design features of the fishway at Hunts Mill Dam.

SECTION VI

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

FINDINGS AND CONCLUSIONS

During evaluation of the anadromous fish restoration needs of the Ten Mile River, all potentially feasible measures to restore fish passage were evaluated. Fish passage alternatives included no action, adding fishways or fish lifts to the existing dams, and dam removal. These alternatives were discussed at periodic coordination meetings with study participants.

Evaluation of alternatives was done based on an evaluation of basic data at each dam site and a determination of agency and public opinion regarding each alternative. Initial data collection activities focused on the analysis of sediments behind the dams, assembling fisheries information and conducting topographic surveys. Once data collection was complete at each dam, study participants were able to discuss and evaluate alternatives. An item that became evident early in the study was that dam removal would require removal or stabilization of accumulated sediments to prevent downstream movement and contamination of the Seekonk River estuary.

Removal of dams would cause other impacts. At Omega Pond, abutters opposed dam removal as loss of the impoundment would eliminate the scenic views and stability it offers. Dam removal would also impact the railroad bridge situated immediately downstream of the dam by increasing flow velocities. Removal of Hunts Mill Dam would impact the historic integrity of the site and impact existing recreational usage. Impacts at Turner Reservoir Dam include loss of a back up water supply and significant changes to a major recreational resource. For these reasons, the state of Rhode Island, city of East Providence and Save the Bay, Inc. oppose removal of dams as a means of restoring fish passage.

Evaluation of various methods of providing fish passage at the three dams determined that Denil type fishways would be the most effective method. Denil fishways are highly efficient, allow passive migration of target species, and are acceptable to State and local agencies and other concerned individuals.

The no action alternative would not meet the goal of the study sponsors and anadromous fish migration would be limited to Omega Pond where local fishermen catch and lift river herring over the dam. The effectiveness of this informal activity would also be limited by the schedules and resources of volunteers, and the labor-intensive nature of the work.

Based on the above analysis and public views and desires, providing Denil fishways at Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam was selected

as the recommended plan to restore anadromous fish passage to the lower Ten Mile River.

It is also concluded that since the cost and scope of the recommended plan are within the limits of Section 206 of the Water Resources Development Act of 1996, that it is appropriate to recommend implementation under this authority.

RECOMMENDATIONS

I recommend that the aquatic ecosystem restoration plan, selected herein to restore anadromous fish to the lower Ten Mile River in East Providence, Rhode Island, be authorized for implementation as a Federal project, with such modifications as the Chief of Engineers may deem advisable, at a total estimated first cost of $1,900,000. In addition, based on the scope and cost of the selected plan, it is recommended that such implementation be pursued under Section 206 of the Water Resources Development Act of 1996.

The plan consists of providing Denil fishways at the three lowest dams on the Ten Mile River: Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam. These fishways will provide for upstream migration of adult Blueback Herring, Alewife, and American Shad to historic spawning areas. Migrant slots would also be cut into the existing spillways at Omega Pond and Turner Reservoir to facilitate downstream migration of juveniles. A migrant slot is not required at Hunts Mill Dam as the shape and irregularities of the existing spillway will provide sufficient water depth for downstream passage. As anadromous returns to the Ten Mile River are likely to exceed available spawning grounds, a fish trap is included at Hunts Mill Dam to relocate excess fish to other watersheds.

This recommendation is subject to the provision that qualified non-Federal sponsors agree to the following items of local cooperation and provisions of the Water Resources Development Acts of 1986 and 1996.

1. Provide 35 percent of total project costs allocated to environmental restoration, as further specified below:

(a) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

(b) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project; and

(c) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the total project cost allocated to environmental restoration.

2. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

3. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

4. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

5. Hold and save the Government free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

6. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

7. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

8. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

9. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair,

replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

10. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the level of ecosystem restoration, hinder its operation and maintenance, or interfere with its proper function, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project.

11. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act. Crediting for relocations performed within the Project boundaries is subject to satisfactory compliance with applicable Federal labor laws covering non-Federal construction, including, but not limited to the Davis-Bacon Act (40 USC 276a et seq), the Contract Work Hours and Safety Act (40 USC 327 et seq), and the Copeland Anti-Kickback Act (40 USC 276c). Crediting may be withheld, in whole or in part, as a result of the non-Federal Sponsor's failure to comply with its obligations under these laws.

12. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army" and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal participation and implementation of flood plain management plans. The non-Federal sponsor is also required to comply with all applicable Federal labor standards and requirements including but not limited to the Davis-Bacon Act (40 USC 276a et seq), the Contract Work Hours and Safety Act (40 USC 327 et seq), and the Copeland Anti-Kickback Act (40 USC 276c). Crediting may be withheld, in whole or in part, as a result of the non-Federal Sponsor's failure to comply with its obligations under these laws.

13. Provide the non-federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement.

14. Do not use Federal funds to meet the non-Federal sponsor’s share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

15. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms.

I have considered all significant aspects including overall public interest; environmental, social and economic effects; and engineering and financial feasibility in concluding that the recommended plan meets the objectives of this study.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Chief of Engineers as proposals for authorization and implementation funding. However, prior to transmittal to the Chief of Engineers, the sponsors, the States, interested Federal agencies, and other parties will be advised of any modification and will be afforded an opportunity to comment further.

_____
Date

_____
Thomas L. Koning
Colonel, Corps of Engineers
District Engineer

E 536,000

OMEGA POND

PROPOSED CONTRACTOR
STAGING AREA (TYPICAL)

PROPOSED CONTRACTOR
ACCESS (TYPICAL)

E 536,000

DEXTER RD.

SPILLWAY

5

5

NEW HAVEN RR

LOCATION OF PROPOSED
FISHWAY

SEEKONK RIVER

N 275,000

100 50 0 100 200FT

SCALE: 1"= 100'

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

WATER RESOURCES DEVELOPMENT PROJECT
RHODE ISLAND ECOSYSTEM RESTORATION
EAST PROVIDENCE, RHODE ISLAND
TEN MILE RIVER FISH PASSAGE

GENERAL SITE PLAN - OMEGA POND

1/10

...\206\Ri\10MiR\Civil\10Mc101.s01 07/02/2004 10:36:48 AM

OMEGA POND

MIGRANT SLOT

GRANITE DAM SPILLWAY

Probes

P1

P2

RAILROAD BRIDGE
STEEL GIRDER

4' wide Denil baffles @ 30" c to c
floor slope is 1 on 8
total length = 42.5'
total # of baffles required = 18

CONCRETE HEADWALL

RAILROAD BRIDGE
STEEL GIRDER

Boring B3

4' wide Denil baffles @ 30" c to c
floor slope is 1 on 8
total length = 57.5'
total # of baffles required = 24

STREAM GUAGE

FLOOD

EBB

TEN MILE RIVER

PROPOSED 4' WIDE
DENIL FISHWAY

10 5 0 10 20FT

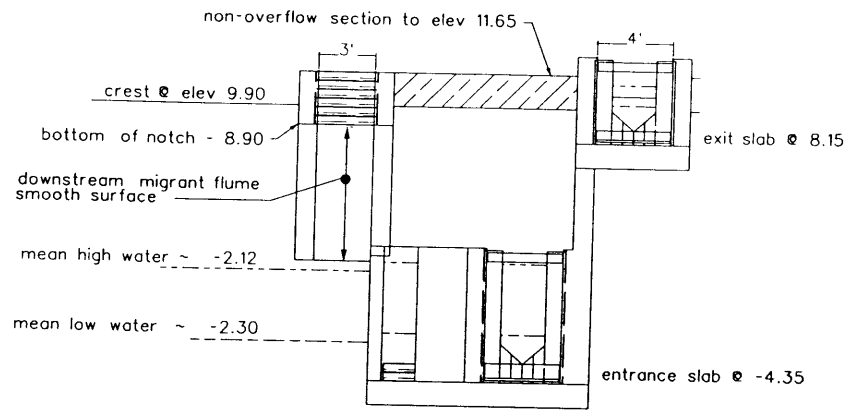
SCALE: 1"= 10'

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

WATER RESOURCES DEVELOPMENT PROJECT
RHODE ISLAND ECOSYSTEM RESTORATION
EAST PROVIDENCE, RHODE ISLAND
TEN MILE RIVER FISH PASSAGE

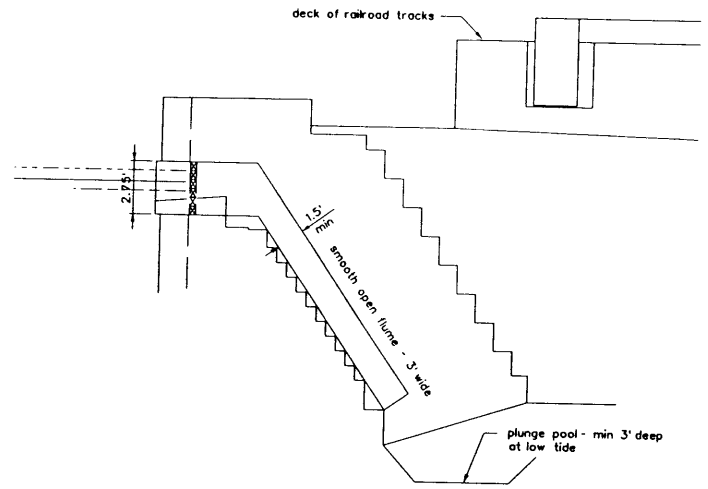
FISHWAY SITE PLAN - OMEGA POND DAM

2/10



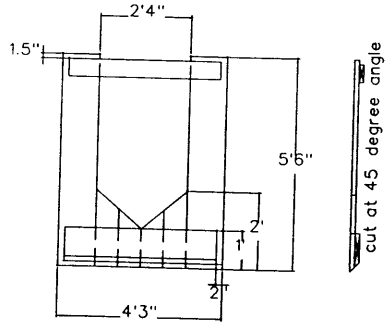
VIEW LOOKING @ D/S FACE DAM W/ FISHWAY

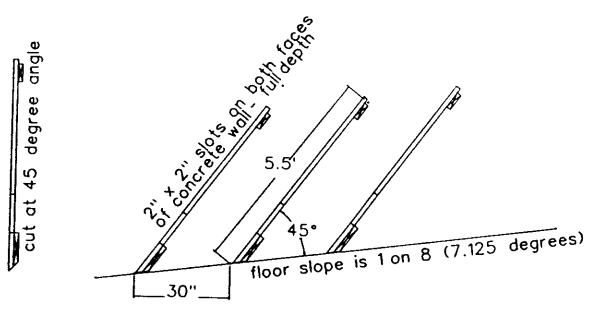
Scale 1"=10'



SECTION VIEW - THRU D/S MIGRANT SLOT

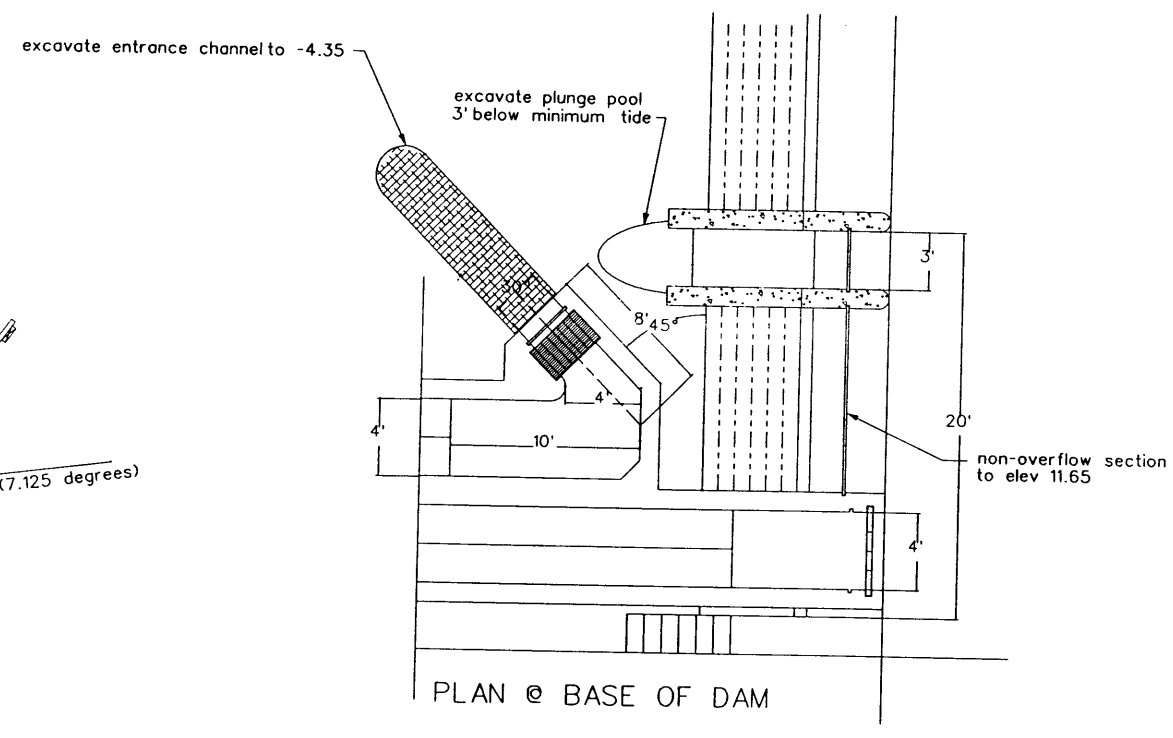
Scale 1"=10'





DENIL BAFFLE DETAILS

Scale 1"=5'



PLAN @ BASE OF DAM

Scale 1"=10'

GRAPHIC SCALE:

1" = 10' 10 0 10 20

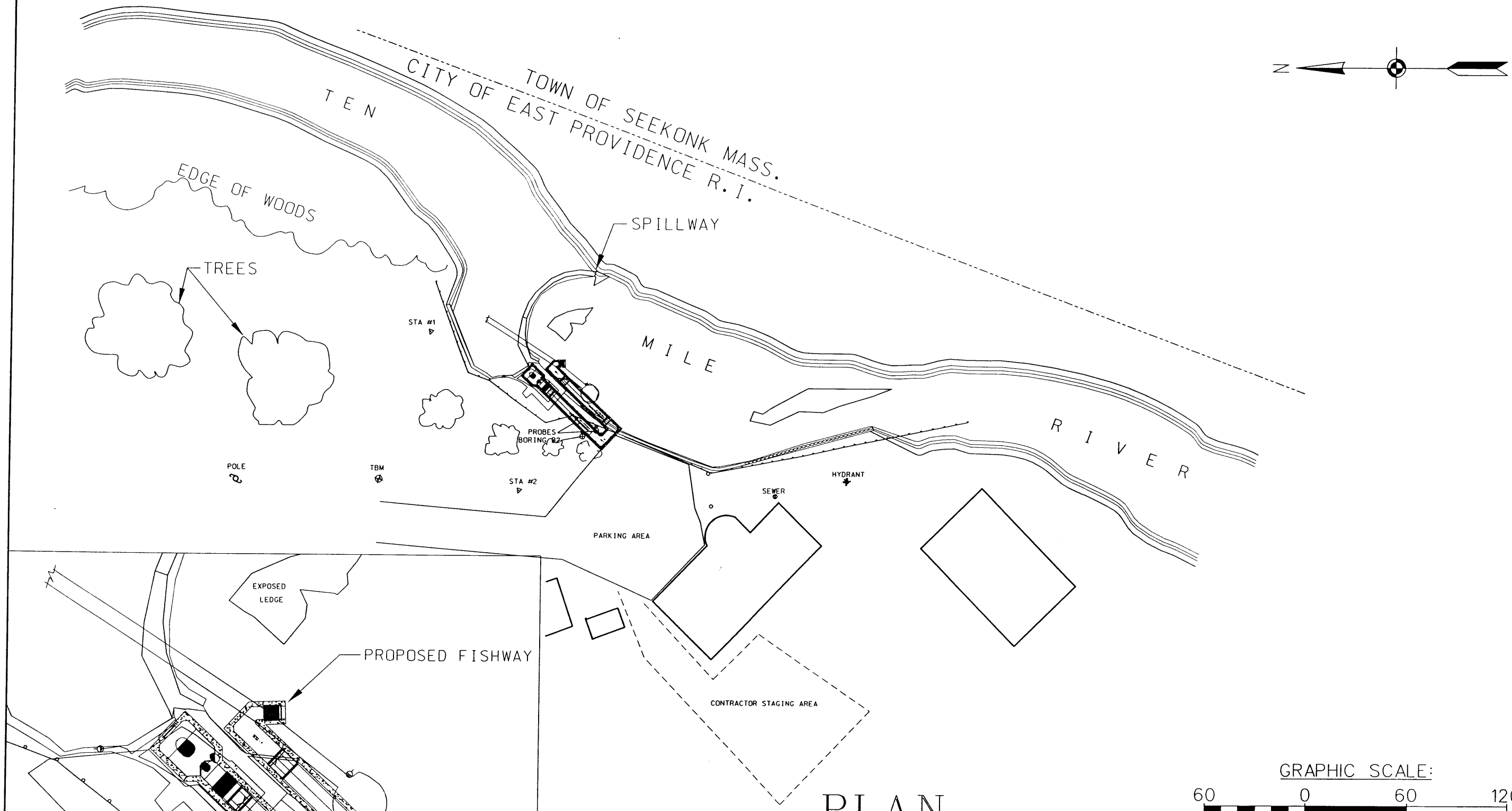
1" = 5' 5 0 5 10

Note: Elevations refer to NAVD 88

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

WATER RESOURCES DEVELOPMENT PROJECT
RHODE ISLAND ECOSYSTEM RESTORATION
EAST PROVIDENCE, RHODE ISLAND
TEN MILE RIVER FISH PASSAGE
OMEGA POND DAM
SECTIONS AND DETAILS

3/10



PLAN

SCALE: 1"=60'

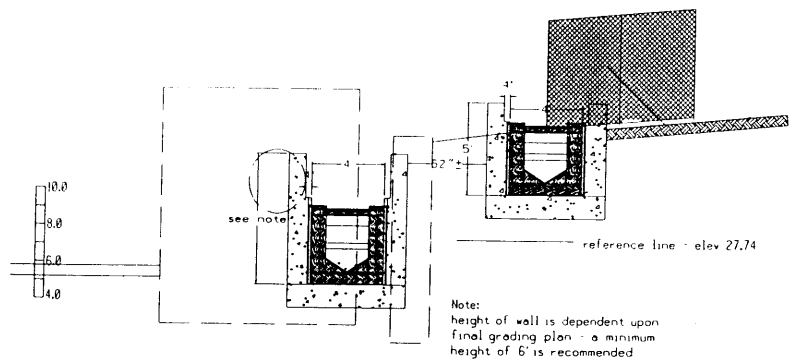
GRAPHIC SCALE:

1" = 60' 60 0 60 120

1" = 20' 20 0 20 40

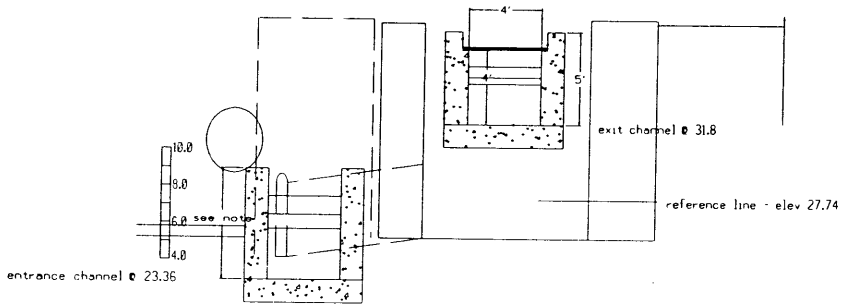
DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS	WATER RESOURCES DEVELOPMENT PROJECT RHODE ISLAND ECOSYSTEM RESTORATION EAST PROVIDENCE, RHODE ISLAND TEN MILE RIVER FISH PASSAGE HUNT'S MILL DAM - GENERAL PLAN	4 10

..\206\Ri\10MiR\Civil\10Mc366.s05 06/29/2004 01:11:06 PM



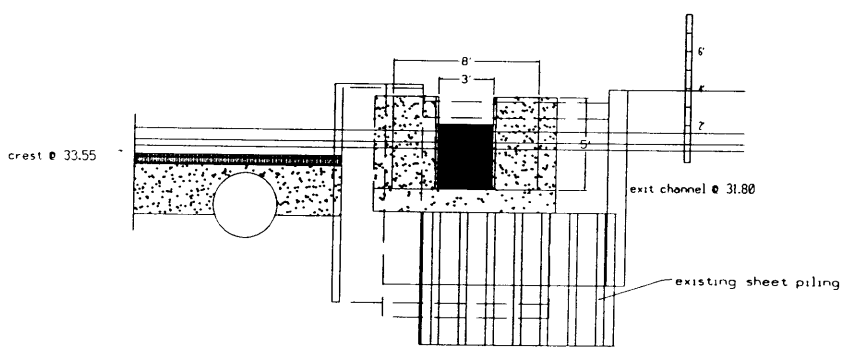
Note:
height of wall is dependent upon final grading plan - a minimum height of 6' is recommended

SECTION C - C

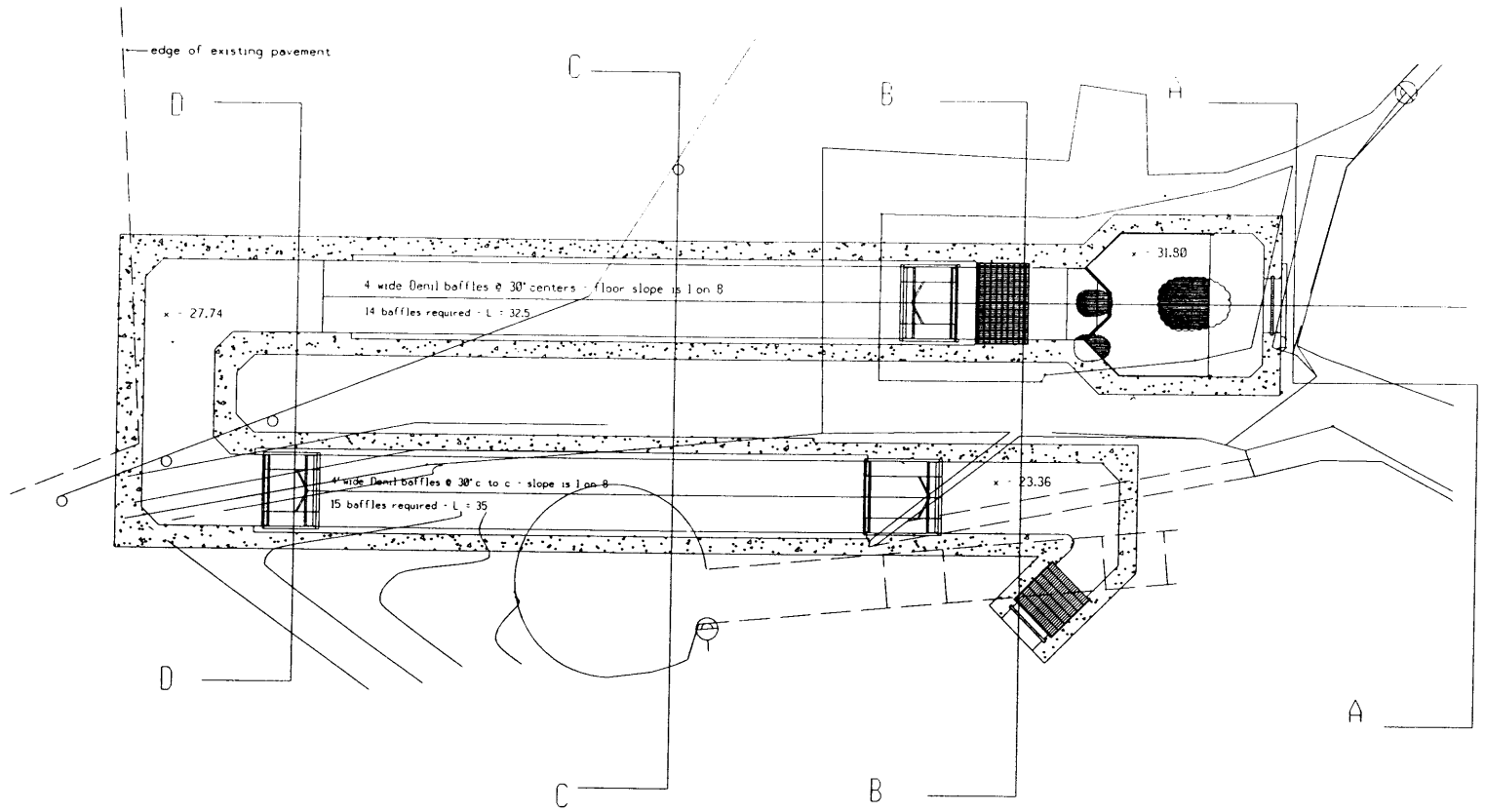


Note:
height of wall is dependent upon final grading plan - a minimum height of 6' is recommended

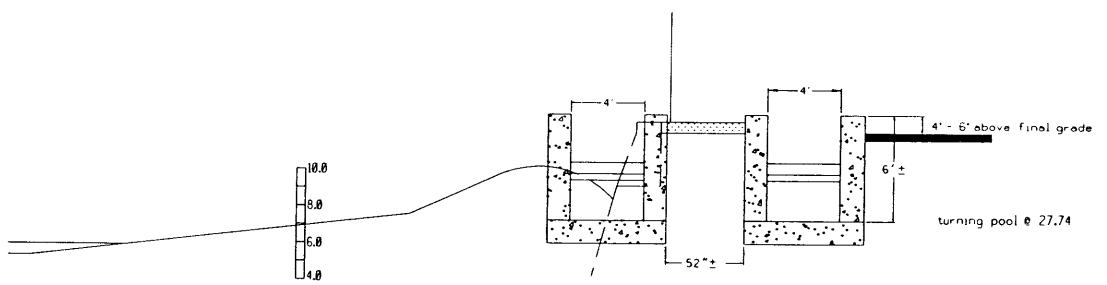
SECTION B - B



SECTION A - A



PLAN VIEW
w/ FISHWAY



SECTION D - D

NOTE: Elevations refer to NAVD 88

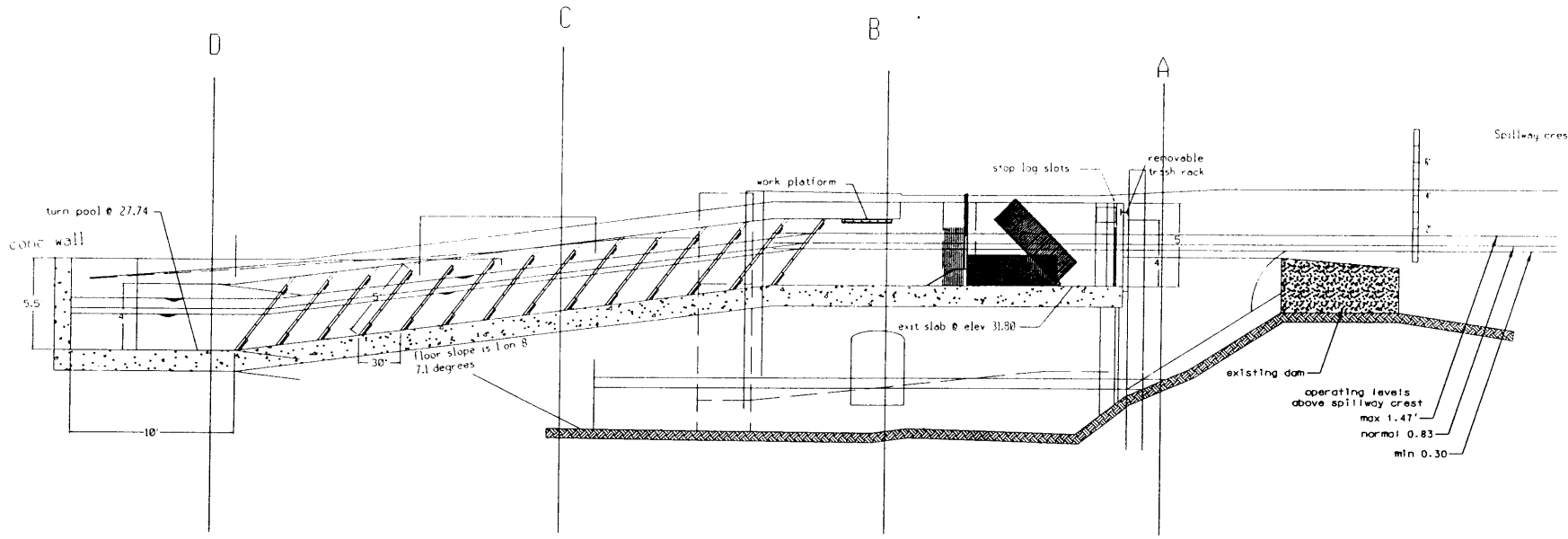
GRAPHIC SCALE:

1" = 10'

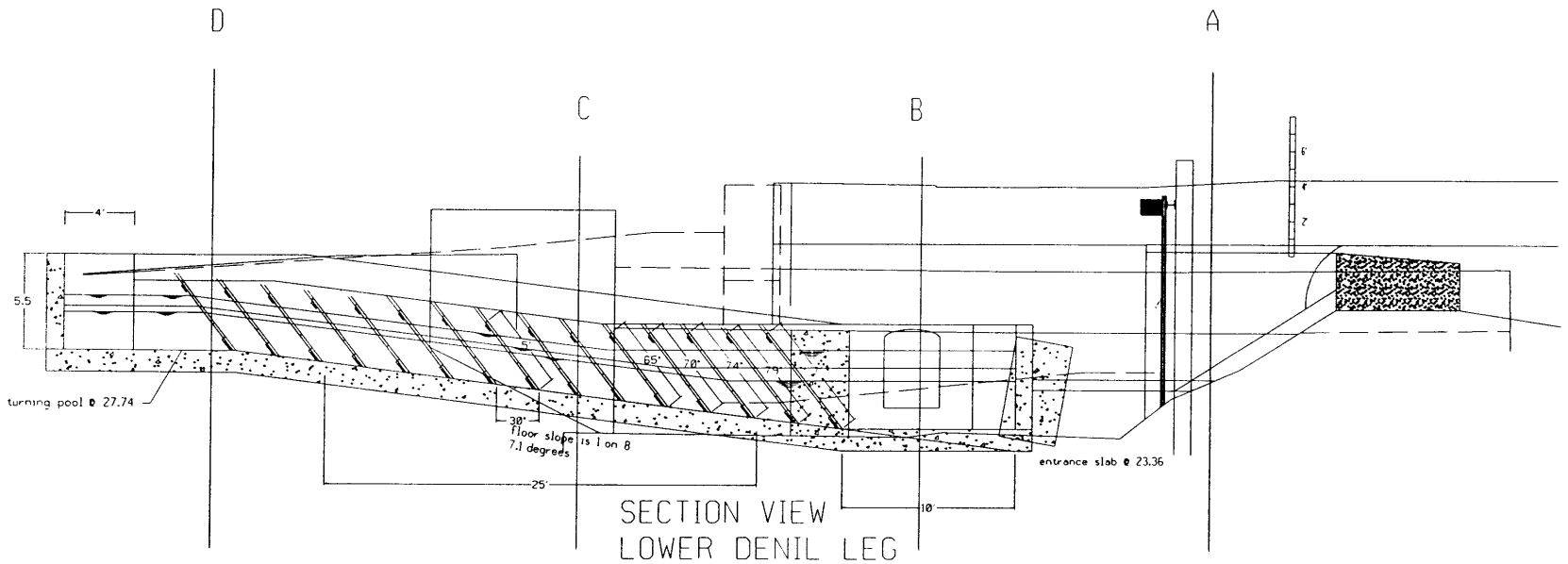
10 0 10 20

DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS	WATER RESOURCES DEVELOPMENT PROJECT RHODE ISLAND ECOSYSTEM RESTORATION EAST PROVIDENCE, RHODE ISLAND TEN MILE RIVER FISH PASSAGE HUNTS MILL FISHWAY DETAILS	5/10

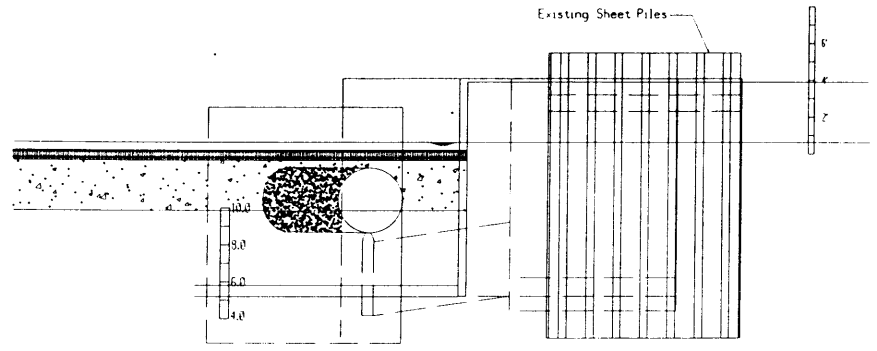
...\206\RI\10MiR\Civil\10Mc369.s11 06/29/2004 12:59:28 PM



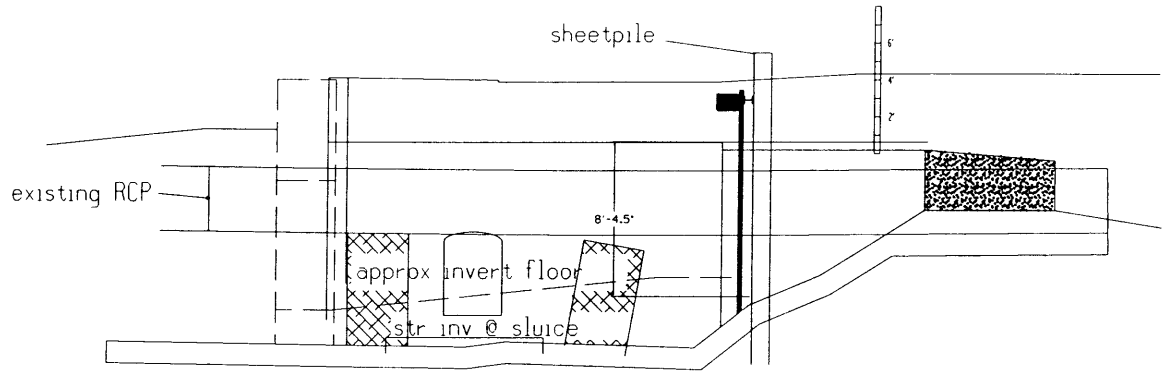
SECTION VIEW
UPPER DENIL LEG



SECTION VIEW
LOWER DENIL LEG

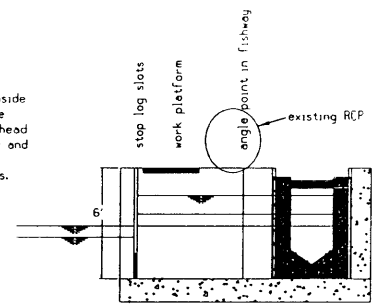


SECTION VIEW FROM HEADPOND



SECTION VIEW FROM RIVER

Note:
stop logs must be placed inside of fishway entrance structure so as to create a 4' to 6' head difference between tailwater and WSE inside of fishway - at normal to low operating flows.

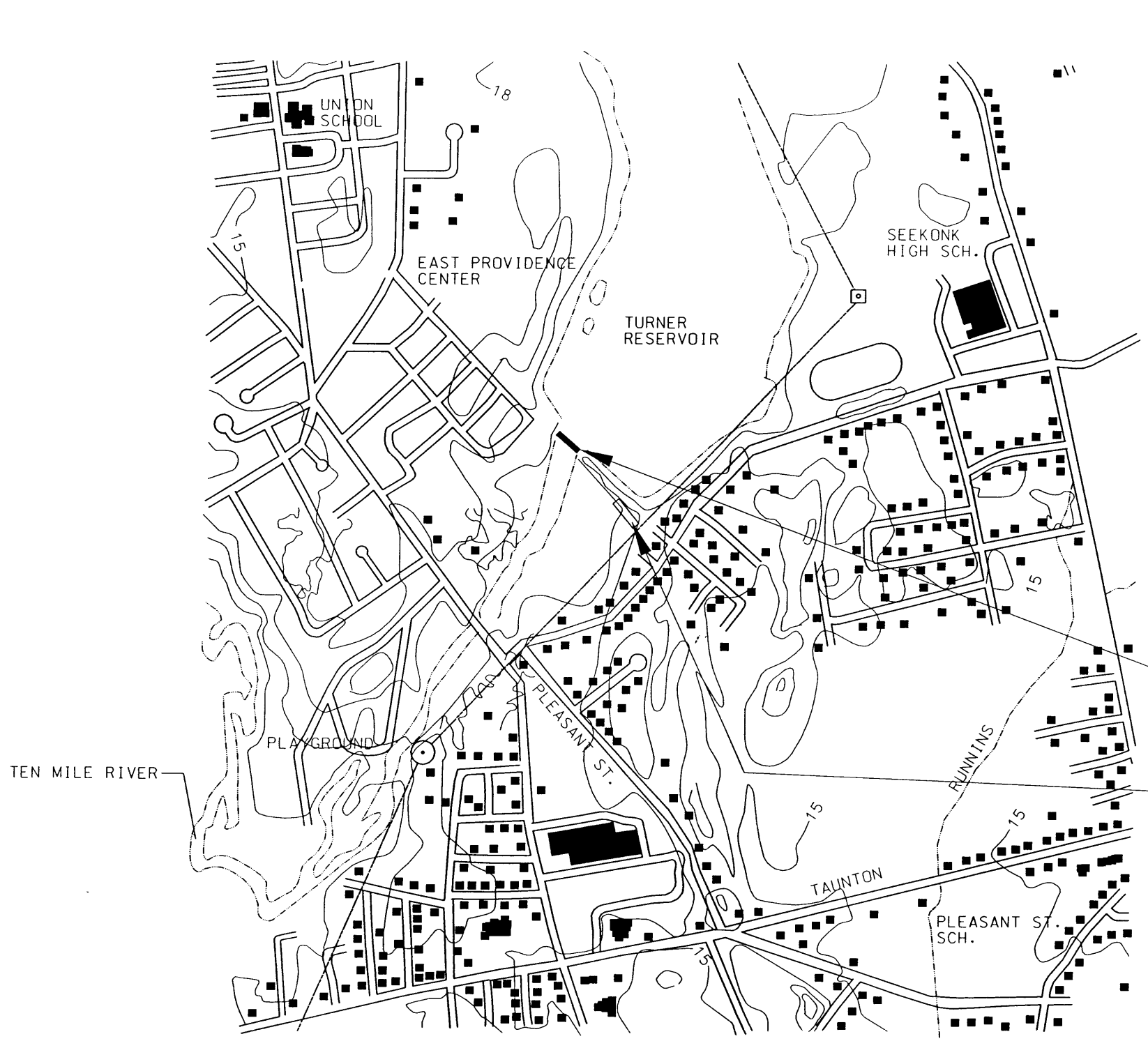


SECTION VIEW
ENTRANCE CHANNEL

NOTE: Elevations refer to NAVD 88

GRAPHIC SCALE:
1" = 10'
10 0 10 20

DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS	WATER RESOURCES DEVELOPMENT PROJECT RHODE ISLAND ECOSYSTEM RESTORATION EAST PROVIDENCE, RHODE ISLAND TEN MILE RIVER FISH PASSAGE HUNTS MILL FISHWAY VIEWS	6 10

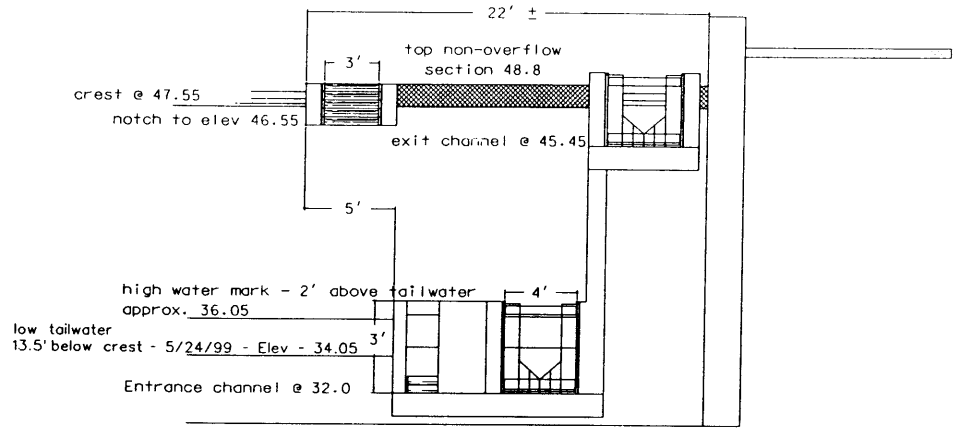


GRAPHIC SCALE:

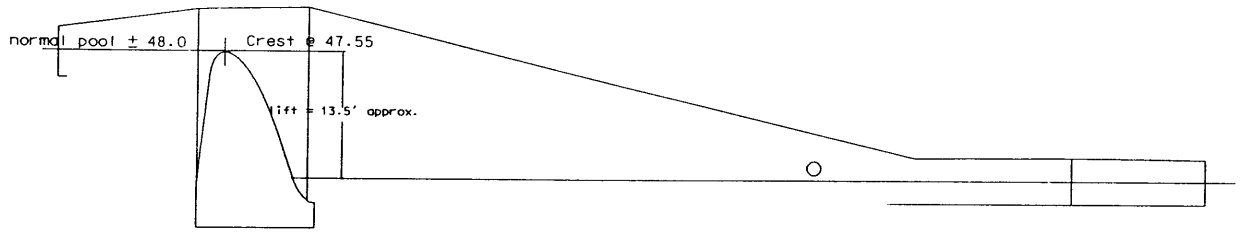
800 0 800 1600

1" = 800'

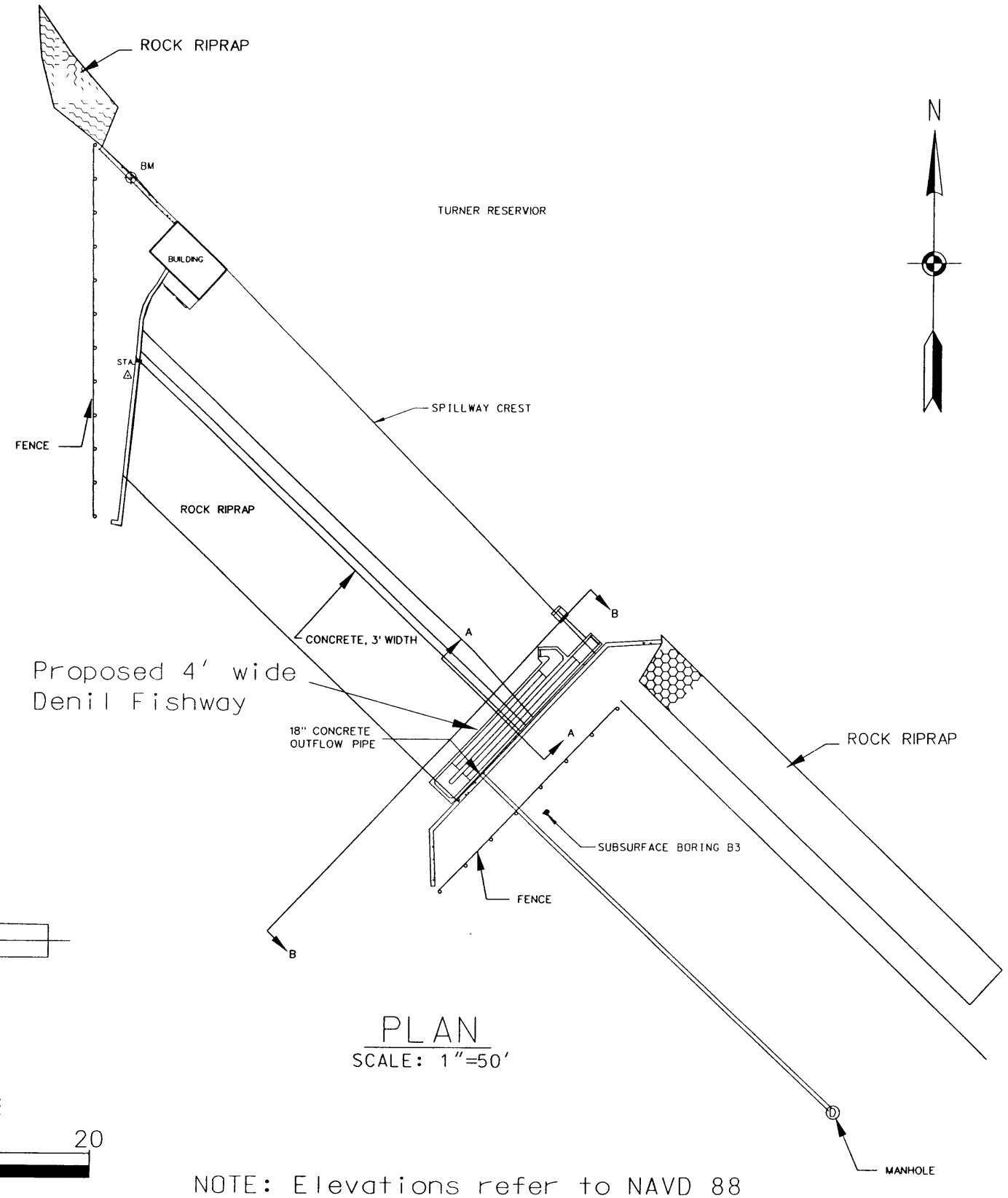
DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS	WATER RESOURCES DEVELOPMENT PROJECT RHODE ISLAND ECOSYSTEM RESTORATION EAST PROVIDENCE, RHODE ISLAND TEN MILE RIVER FISH PASSAGE TURNER RESERVOIR GENERAL PLAN	7/10



SECTION A-A
Scale: 1"=10'



SECTION B-B
Scale: 1"=20'



PLAN
SCALE: 1"=50'

GRAPHIC SCALES:

1" = 10' — 10 0 10 20

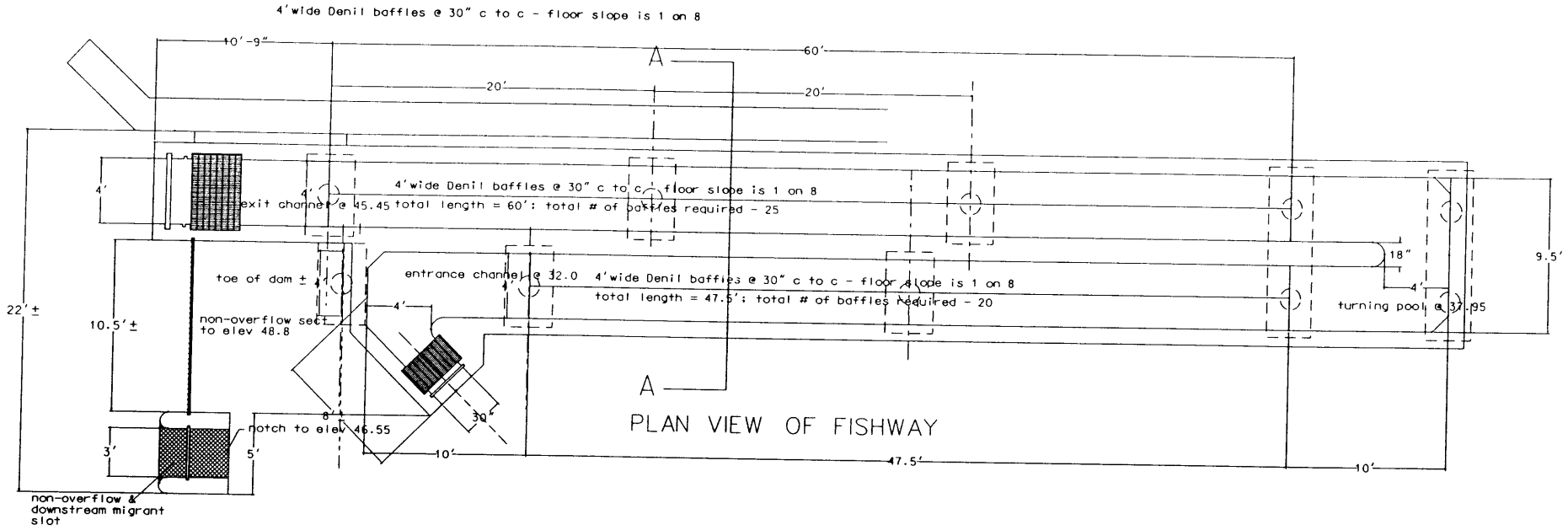
1" = 20' — 20 0 20 40

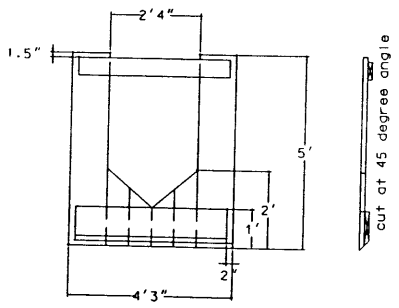
1" = 50' — 50 0 50 100

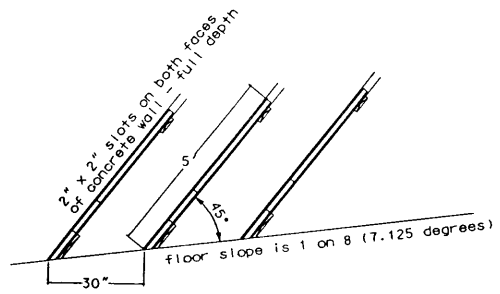
NOTE: Elevations refer to NAVD 88

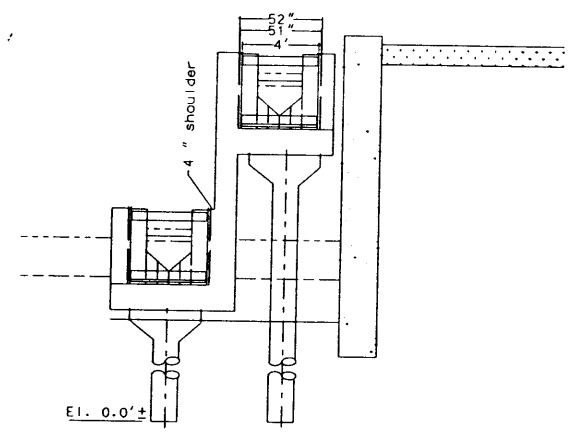
DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS	WATER RESOURCES DEVELOPMENT PROJECT RHODE ISLAND ECOSYSTEM RESTORATION EAST PROVIDENCE, RHODE ISLAND TEN MILE RIVER FISH PASSAGE TURNER RESERVOIR DAM	8/10

...\206\Ri\10MiR\Civil\10Mc403.s07 06/29/2004 12:57:46 PM

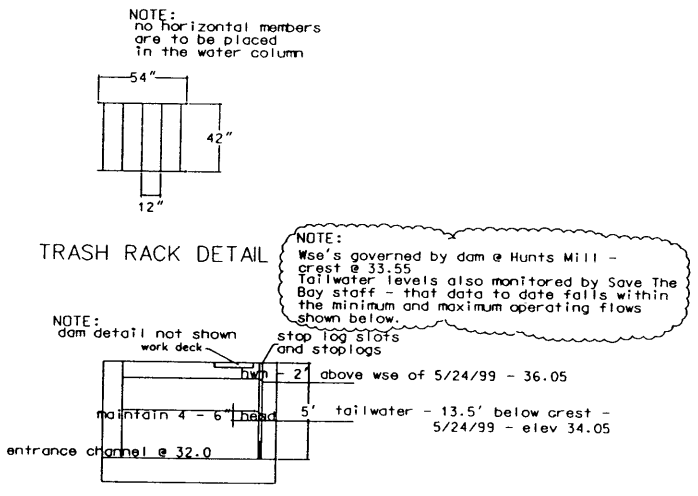








SECTION A - A



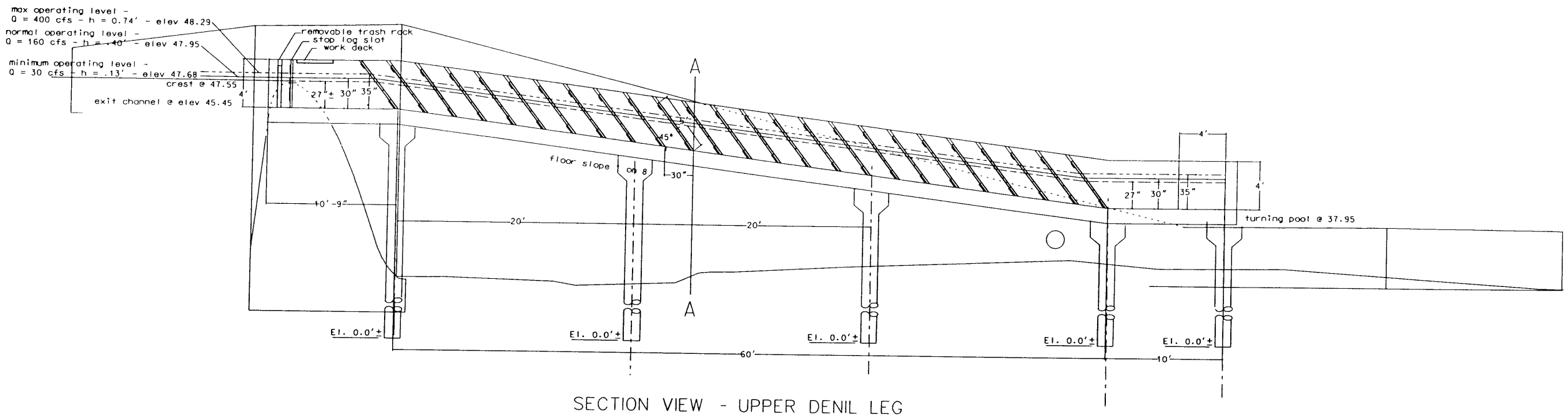
SECTION VIEW - @ ENTRANCE CHANNEL

GRAPHIC SCALE:

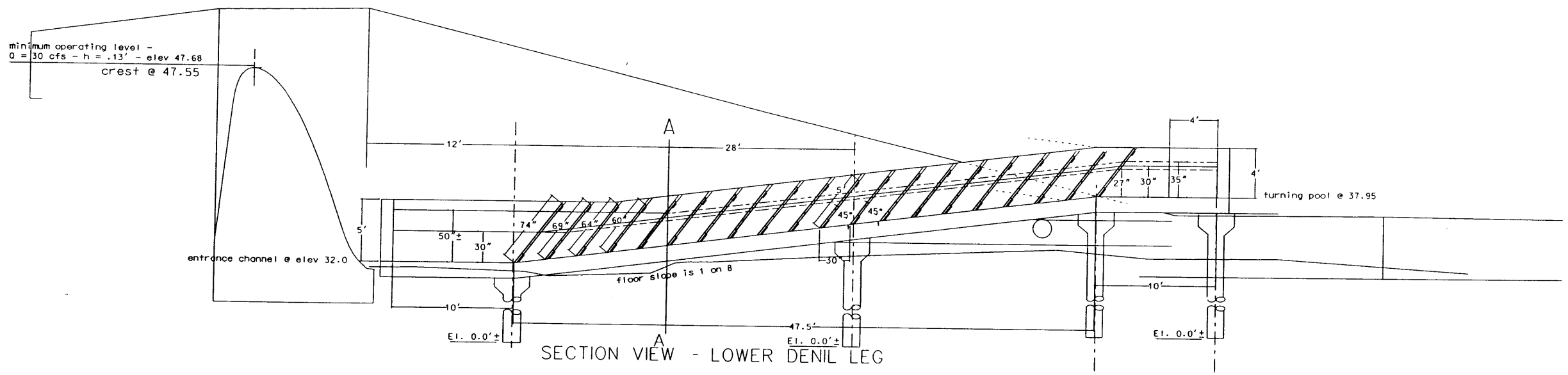
1" = 10'

10 0 10 20

DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS	WATER RESOURCES DEVELOPMENT PROJECT RHODE ISLAND ECOSYSTEM RESTORATION EAST PROVIDENCE, RHODE ISLAND TEN MILE RIVER FISH PASSAGE TURNER RESERVOIR FISHWAY DETAILS	9 10



SECTION VIEW - UPPER DENIL LEG



SECTION VIEW - LOWER DENIL LEG

GRAPHIC SCALE:

1" = 10'

10 0 10 20

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

WATER RESOURCES DEVELOPMENT PROJECT
RHODE ISLAND ECOSYSTEM RESTORATION
EAST PROVIDENCE, RHODE ISLAND
TEN MILE RIVER FISH PASSAGE

TURNER RESERVOIR FISHWAY DETAILS

10/10

Rhode Island Ecosystem Restoration Project
Ten Mile River Aquatic Habitat Restoration Study
Anadromous Fish Run Restoration
East Providence, Rhode Island

Draft Environmental Assessment

U.S. Army Corps of Engineers
New England District
Environmental Resources Section

April 2005

Ten Mile River Draft Environmental Assessment
Table of Contents

Ten Mile River Draft Environmental Assessment
Table of Contents (Con't)

Ten Mile River Draft Environmental Assessment
Table of Contents (Con't)

LIST OF FIGURES

Rhode Island Ecosystem Restoration Project
Ten Mile River Aquatic Habitat Restoration Study
Anadromous Fish Run Restoration
East Providence, Rhode Island

Environmental Assessment

I. Introduction

The Ten Mile River begins in Plainville Massachusetts, and flows an approximate distance of 18 miles, through the towns of North Attleborough, Attleboro, and Seekonk, Massachusetts, and an additional five miles through East Providence, Rhode Island, before joining the Seekonk and later the Providence River and Narragansett Bay. The total drainage area of the watershed is about 56 square miles, and it is the smallest of the 27 major watersheds in Massachusetts. It includes the towns (in addition to those noted above) of Wrentham, Foxborough, Rehoboth, and Pawtucket, RI. Several tributaries join the Ten Mile River as it flows toward the Seekonk River, including the Bungay River in Attleboro, and the Sevenmile River in Seekonk.

Historically, many New England coastal rivers including the Ten Mile River provided habitat for various species of anadromous fish. These included blueback herring and alewives (collectively referred to as river herring), American shad, and Atlantic salmon, as well as the catadromous American eel. However, during the last approximately 200 years, dams were built along these rivers to provide water power for various industrial purposes. These dams blocked the upstream migration of pre-spawning adults of anadromous fish to their historic spawning habitat in these rivers. Consequently their populations have been either reduced or eliminated from the rivers. On the Ten Mile River, dams have also obstructed fish passage, and as a result, historic anadromous fish runs have been eliminated or reduced. The proposed project would provide fish passage, in the form of fish ladders at three of these dams on the Ten Mile River. These dams, Omega Pond, Hunts Mill and Turner Reservoir, are the lowest three dams on the river.

During the last two decades, various state and federal government agencies have been working cooperatively to restore anadromous fish to their historic habitat in many New England Rivers. Restoration efforts include identification of specific restoration locations, stocking of anadromous fish to historical upstream spawning and nursery habitats, and provision of fish passage beyond dams, by either dam removal, or creating other by-pass structures such as fish ladders, lifts and/or partial dam breaching. In addition, studies of potential restoration areas have been conducted to identify habitat, and the best methods to restore and/or access this habitat. In 1999, the U.S. Army Corps of Engineers completed the Rhode Island Ecosystem Restoration Reconnaissance Report/Analysis, under Section 905(b) of the Water Resources Development Act of 1986 (WRDA 86). This authority provides for cost shared studies of degraded aquatic ecosystems in order to determine best methods of restoration and to implement habitat restoration projects. In this study, the Ten Mile River was identified as a river where

anadromous fish could be restored by providing fish passage beyond and/or over the obstructing dams.

Three dams were identified as requiring fish passage to restore anadromous fish to the lower Ten Mile River. These are Omega Pond Dam, located at the outflow of the Ten Mile River into the Seekonk River (at tidewater); Hunts Mill Dam, 2.5 miles upstream, and Turner Reservoir Dam, located approximately one-half mile upstream from Hunts Mill Dam. The locations of these dams are shown in Figure EA-1. Omega Pond Dam is currently owned by the city of East Providence and is constructed of masonry and earth. It has a hydraulic height of 15 feet and forms Omega Pond, which covers approximately 33 acres (Figure EA-2). Hunts Mill Dam is owned by the city of East Providence, and is constructed of masonry and rockfill. It has a hydraulic height of 8.5 feet, and forms a small pond, Hunts Mill Pond, which, during higher flows, can extend to the base of Turner Reservoir Dam (Figure EA-3). Turner Reservoir Dam is owned by the city of East Providence, and is constructed of concrete and earth. The dam has a hydraulic height of 22 feet, and forms the 300-acre Turner Reservoir/Central Pond complex (Figure EA-4). These dams currently block the upstream migration of native anadromous fish to their historical spawning and nursery habitat along the Ten Mile River and points upstream from Turner Reservoir.

Providing fish passage beyond these dams would open-up approximately three miles of riverine habitat below Turner Reservoir, as well as approximately 340 acres of lacustrine habitat in both Turner Reservoir and Omega Pond. In addition, approximately one (1) river mile of riverine spawning and nursery habitat for anadromous shad and blueback herring will become available in the areas upstream from Turner Reservoir/Central Pond along the Ten-Mile River. This would allow anadromous alewives, blueback herring, and American shad access to historical riverine and/or lacustrine spawning and nursery habitat from the mouth of the river to areas upstream from Turner Reservoir. The following Environmental Assessment addresses the impacts of constructing fish passage facilities at the dams at Omega Pond, Hunts Mill and Turner Reservoir in accordance with the National Environmental Policy Act of 1969.

II. Project History

Manufacturing in the Ten Mile River watershed began in the late 1700's, and with it, the construction of dams, which provided waterpower for the numerous industries that developed along its corridor. With the completion of the Boston and Providence Railroad in the mid-1800's, a transportation link was established between the industries on the Ten Mile River, and other locations, allowing for increased production. The primary industries included jewelry and textiles, however paper, primary metals and machinery were manufactured in various towns and cities within the watershed. In addition, the river was used for process water and as a conduit for wastewater disposal. As a result, the Ten Mile River began experiencing poor water quality by the mid-1900's. (http://www.ci.attleboro.ma.us/tenmileriver/riverfacts.htm).

Figure EA-2. Omega Pond Dam and Omega Pond

Figure EA-3. Hunts Mill Dam and Hunts Mill Pond

Figure EA-4. Turner Reservoir Dam and Turner Reservoir

The lower section of the river flows through the city of East Providence, which was established in 1636. Early development along the river included Hunts Mill Dam that was constructed by John Hunt in approximately 1770 to power a gristmill (http://www.eastprovidence.com/historic/hisatr.html). Industrialization of this area continued with the construction of a bridge across the Seekonk River in 1793. This was a major advance in transportation access, which not only linked East Providence to Providence, but improved north-south travel between this area and Boston. As a result, additional industries became established in the City beginning in the early 1800's and continuing through the present. During this time, the dams at Omega Pond and Turner Reservoir were constructed. Omega Pond was used for process water for several industries, including steel product manufacturing, and Turner Reservoir was used as a water supply for the city of East Providence. These dams not only obstructed the passage of anadromous fish on the Ten Mile River, but many of these industries discharged various wastes into the river, severely impacting water quality.

Since the implementation of the Clean Water Act and Amendments of 1972 and 1977, which provided funding for construction of wastewater treatment plants, the river is significantly cleaner now than it was in the 1960's and 1970's. However, it is still impacted by the effects of development and the residual levels of various pollutants from the existing and past usage. More recently, the Ten Mile River has been the subject of comprehensive habitat and water quality restoration efforts, by various private, state, local and federal agencies. These include efforts to reduce point and non-point sources of pollution as well as anadromous fisheries restoration. During 1996 and 1997, Turner Reservoir was stocked with alewives and blueback herring by the Rhode Island Department of Environmental Management (RIDEM). This resulted in successful spawning as indicated by the netting of juvenile river herring in the fall of those years. In addition, habitat studies conducted during that time indicated that the Ten Mile River could also support American shad. This study therefore evaluated appropriate alternatives to provide fish passage at the three lowermost dams on the Ten-Mile River to restore anadromous fish to their historic upstream habitat.

III. Project Need

Historically, the Ten Mile River provided spawning and nursery habitat for anadromous alewives and blueback herring (collectively referred to as river herring), American shad, Atlantic salmon, and the catadromous American eel. These runs were eliminated and/or significantly reduced with the construction of dams along the Ten-Mile River, including those at Omega Pond, Hunts Mill, and Turner Reservoir/Central Pond. In addition, with the growth of industry along the river and the subsequent usage of the waterway for the discharge of industrial/municipal effluent, the water quality became less able to support many biological communities. Within the last thirty years, the water quality has improved sufficiently to support large biological communities, including populations of many native and stocked fish species. This is due largely to the implementation of the Clean Water Act and resulting reduction and/or elimination of

many of the discharges of industrial/municipal effluent. Although biological communities have improved and/or returned, restoration of the anadromous species that once inhabited the Ten Mile River cannot be accomplished since dams obstruct upstream migration of pre-spawning adults. Although river herring have been stocked and have successfully reproduced in Turner Reservoir/Central Pond, self-sustaining anadromous populations of these fish cannot be sustained without fish passage at the Omega Pond, Hunts Mill and Turners Reservoir dams. A remnant river herring population exists in Omega Pond, but it is dependent upon the efforts of local fishermen to net the returning pre-spawning adults (which gather at the base of the dam in the Seekonk River) and lift them over the dam into Omega Pond. If adequate fish passage was provided, these fish could enter Omega Pond and either spawn there or continue their upstream migration to spawn in additional upstream riverine habitat. Providing fish passage at the next two upstream dams (Hunts Mill and Turner Reservoir) would allow these fish access to approximately 297 acres of lacustrine habitat in Turner Reservoir/Central Pond. The fact that river herring are returning to the base of Omega Pond Dam in the Ten Mile River indicates that there is acceptable spawning and nursery habitat, as well as acceptable water quality conditions for these fish in Omega Pond and the upstream reach of the Ten Mile River below Hunts Mill Pond. In addition, the Rhode Island Department of Environmental Management, Division of Fish and Wildlife stocked river herring in Turner Reservoir during the spring of 1996 and 1997. In the fall of those years, juvenile river herring were netted, indicating that successful spawning had occurred (Save the Bay, 2002). The fact that these species have successfully spawned in Turner Reservoir (from prior stocking efforts) indicates that the same habitat criteria are being met there as well.

Additional benefits to the ecosystem would be incurred by the provision of fish passage on the Ten Mile River. A fishway on the Westfield River in Massachusetts (a tributary to the Connecticut) has passed in addition to the species noted above, American eel, white sucker, largemouth bass, smallmouth bass, brook trout, brown trout, rainbow trout, carp and striped bass (Slater, 2001). These fish have been observed using the fishway for spawning and/or seasonal migrations (i.e. during high temperatures and lower flows, many salmonid species will seek refuge in colder water tributaries upstream from a larger river). It is presumed that similar usage may occur in the Ten Mile River, since fish from one impoundment will be able to move upstream beyond Turner Reservoir/Central Pond.

Other ecological benefits include the increase in productivity associated with the re-establishment of anadromous fishes to their historical habitat. If shad and blueback herring become established in this river, the out-migrating juveniles could provide forage not only for resident warmwater species in the Ten Mile River (including the impoundments of Turner Reservoir and Omega Pond) but for marine and estuarine fish in the Seekonk and Providence Rivers downstream from Omega Pond. In addition, returning adults could provide forage for larger fish in Narragansett Bay. These can include striped bass, which move into the areas around the same time as many of the returning shad and river herring, as well as many federally managed species inhabiting the area. The overall benefits would not only be to an ecosystem, but for anadromous

fish, which by definition (ER 1105-2-200) are a federally significant resource. Therefore, the project outputs are in the federal interest.

Providing fish passage at the three dams is also in accordance with the overall Coastal America cooperative effort to restore anadromous fish to the Northeast, as well as the restoration plans of various other state and local government agencies. Objective 3.2 of Goal 3 in the Ten Mile River Draft Five Year Watershed Action Plan (2002-2006) (prepared by the Commonwealth of Massachusetts Executive Office of Environmental Affairs, Ten Mile River Watershed Team Action Planning Subcommittee) is to "create physical characteristics to fully support aquatic life." This includes those characteristics necessary to restore historic anadromous fish to their historical habitat. Therefore the restoration also has institutional significance.

IV. Project Description

The proposed project would provide anadromous fish passage at Omega Pond Dam, Hunts Mill Dam, and Turner Reservoir Dam, the first three dams on the Ten-Mile River, involving the construction of a concrete Denil type fish ladder at each dam. This would allow anadromous alewives access to approximately 340 acres of spawning habitat within Omega Pond, Hunts Mill Pond and Turner Reservoir/Central Pond, as well as an additional mile of riverine spawning habitat for blueback herring and American shad in areas of the Ten Mile River upstream from Turner Reservoir Dam.

At Omega Pond, a 4-foot wide concrete Denil fishway would be installed on the left side (looking downstream) of the spillway. It would have its downstream entrance on the left bank (in tidewater) at the base of the spillway, run along the existing retaining wall, and notch into the left side of the existing spillway to form the exit channel. The fishway would be operational during periods of upstream fish migration, and have mechanisms to provide adequate flow during these times. A similar structure would be constructed at Hunts Mill Pond, but would be located on the right side of the spillway, having its downstream entrance and upstream exit channels located on the right side of the dam and abutments. A significant feature of the Hunts Mill fishway would be the inclusion of a fish trap at the fishway exit. As anadromous fish returns to the Ten Mile River are likely to exceed available spawning grounds, this would allow the Rhode Island Division of Fish and Wildlife to relocate excess fish to other coastal watersheds. At Turner Reservoir Dam, a similar Denil fishway would be constructed along the left side of the spillway abutment. It would have its downstream entrance in the stilling basin at the base of the spillway, run along the left embankment to a 180 degree turning pool, and then proceed to the exit channel at the left end of the spillway. Portable dams or cofferdams will be required at each site to de-water the construction areas. Less than 100 cubic yards of bank and/or riverbed material will be excavated at each location and it will either be replaced or disposed of at an approved upland site.

V. Alternatives Evaluation and Impacts of Non-Implemented Alternatives

A. No Action

Under the No Action Alternative, no modifications would be made at the existing dams and fish would be unable to pass from the Seekonk River to any of the areas upstream from Omega Pond Dam. The remnant river herring population that is currently being netted over Omega Dam by volunteers would be the only anadromous river herring that would be able to spawn in Omega Pond and the additional reach of the Ten Mile River between Omega Pond and Hunts Mill Dam. In addition, the habitat upstream from Hunts Mill Dam, which would include Hunts Mill Pond, the stretch of the river between Hunts Mill Pond and Turner Reservoir, and the 297 acres of lacustrine habitat in Turner Reservoir and Central Pond, would be inaccessible to these river herring. Any efforts to establish a river herring population in these areas of the Ten Mile river upstream from Omega Pond would require manual netting in order to move them over these dams into the upstream areas. This is not effective, in that it is extremely labor intensive and involves handling these upmigrating fish in a way that can cause stress and/or injury (i.e. it involves removing the fish from the water, allowing them to contact the mesh as well as other individual fishes which can wound/abrade scales and skin, making them susceptible to fungal and other infections). In addition, there is no formally established program of netting currently in place at these dams. The existing netting is being done informally by volunteer fishers and limited to their own schedules and resources. Therefore, under the No Action Alternative, a self-sustaining population of anadromous river herring could not be established in the Ten Mile River upstream from Omega Pond. In addition, the ecological benefits associated with restoring these fish to the river would not be realized, which may include the passage of other historical anadromous species such as Atlantic salmon (a federally listed Endangered species).

B. Dam Removal

In this alternative, one or more of the three dams that are currently blocking upstream migration of anadromous fish would be removed allowing the river to flow freely through the stretch from Turner Reservoir to the Seekonk River. The impoundments behind the dams would drain, and the habitat would convert from lacustrine to riverine.

1. Omega Pond

At Omega Pond, if the dam was removed, the head of tide would be re-located approximately 2500 feet further upstream to a point near the Conrail railroad bridge (December 1992, East Providence Flood Insurance Study, FEMA), and the area between the upstream end of Omega Pond and the dam would revert to its former habitat. Historically, this was a salt marsh under both tidal and freshwater influence. The tides would be allowed to naturally fluctuate in the area occupied by Omega Pond, and the

restored habitat would become repopulated with historic estuarine species, including the anadromous river herring and shad. In addition, these anadromous fish would have access to an additional 2 miles of riverine habitat extending from the Conrail Bridge to Hunts Mill Dam.

Currently, there is a large amount of sediment behind Omega Pond Dam. If the dam was removed, this sediment would naturally be flushed downstream into the tidewater of the Seekonk River. However, since recent testing has indicated elevated levels of arsenic as well as other potential contaminants in the sediment behind Omega Pond, this material could potentially contaminate downstream areas in the Seekonk and Providence Rivers if it were released from behind Omega Dam by affecting both water and sediment quality. If the dam were to be removed, these sediments would need to be removed from behind it (by dredging) and disposed of in a suitable upland disposal area. This would substantially increase the cost of the proposed project. In addition, many of the abutters to Omega Pond are opposed to dam removal because of the loss of the impoundment. Therefore, the state of Rhode Island, city of East Providence and Save the Bay, Inc. have eliminated the option of dam removal as a potential alternative for restoring fish passage.

Additional effects of the removal of Omega dam would be the loss of the existing warm water fishery in Omega Pond, including river herring spawning habitat. With the dam removed, the impoundment would drain, and the Ten Mile River would revert to its former river channel allowing the area of Omega Pond to become tidally influenced, changing the entire ecosystem from open freshwater (lacustrine) to estuarine. The results would be corresponding changes in both the vegetation, and fish and wildlife communities. The existing freshwater wetland vegetation currently inhabiting the edges of Omega Pond would be replaced by those species currently inhabiting the Seekonk River estuary, into which the Ten Mile River drains, with corresponding changes in habitat for existing fish and wildlife.

Although the dam removal may add beneficial estuarine habitat, as noted, it would eliminate river herring spawning habitat. River herring can contribute to the forage base of many marine and estuarine fish species, and a reduction in spawning habitat would result in fewer of these fish entering the marine environment. Since the focus of this project is to restore anadromous fish habitat, the loss of Omega Pond would reduce the available freshwater spawning habitat for these anadromous river herring and shad species.

2. Hunts Mill Dam

In this alternative, Hunts Mill Dam would be removed, and the small impoundment behind the dam would be eliminated, opening up an additional half mile of riverine habitat upstream to Turner Reservoir. The habitat immediately upstream from the dam would change from lacustrine to riverine, exposing the former riverbed containing rock and gravel, with associated pools and riffles. Corresponding changes in vegetation would occur, with the formerly submerged banks becoming vegetated with riparian and wetland species. River herring spawning habitat consisting of the open water

of Hunts Mill Pond would be significantly reduced. There would also be a reduction in the existing warmwater fish assemblage due to a smaller impoundment size (reduced carrying capacity), and a reduction in littoral spawning and deepwater habitat, which is necessary for the reproduction and survival of many lacustrine fish species. Sediments behind the dam would need to be either removed by dredging, or allowed to naturally disperse downstream which could affect water quality and habitat.

Dam removal could improve water quality as the river flows over historic rock and riffle runs and dissolved oxygen levels are increased. In addition, there would be local ecosystem changes (i.e. changes in benthic invertebrate communities) which would result from the scouring of the formerly impounded/sediment covered stream channel. However, this small section of river would not be restored to a coldwater system due to the influence of the upstream dam at Turner Reservoir. As noted for Omega Pond, the reduction in potential river herring and shad spawning habitat could result in fewer numbers of these fish entering the marine environment and therefore would not provide any benefits to estuarine and marine fish species which may utilize them as food.

Hunts Mill Dam and the associated structures on the abutting property are currently on the National Register of Historic Places, and the existing building serves as a museum for the public. In addition, the city of East Providence (the current owner of the dam and property) has created a public park/recreation area at this location, with the curved spillway, associated waterfalls, and the small impoundment serving as aesthetic resources. There are also plans to make additional improvements at the site, with the intention of enhancing and maintaining the dam as an historic landmark. Based primarily on historic concerns, the state of Rhode Island, and the city of East Providence have eliminated this option from the possible alternatives for restoring fish passage.

3. Turner Reservoir Dam

In this alternative, Turner Reservoir Dam would be removed, and the 297-acre impoundment forming the Turner Reservoir/Central Pond complex would drain, opening approximately two additional river miles of historic riverine habitat and adjacent riparian areas. This would allow free passage for up-migrating river herring and shad, as well as other anadromous species, to the additional riverine habitat within the former impoundment, as well as an additional mile of habitat upstream from Central Pond in the Ten Mile River. The river herring and shad spawning habitat provided by the existing impoundment would be significantly reduced, but would depend upon the flow characteristics of the opened free flowing river. The warmwater fish habitat created by the impoundment would be reduced, and many of the existing lacustrine species may be eliminated due to the loss of specific habitat components (spawning and deepwater habitat). The upstream wetlands at the inflow of the Ten Mile River would drain, as well as some of the other impounded areas along the Turner Reservoir. This would negatively affect waterfowl habitat by reducing open water and associated emergent/scrub-shrub wetland. Wetland birds, and reptile and amphibian species that inhabit these areas would also be negatively affected.

Benefits to dam removal would be similar to those noted above for Hunts Mill Pond, where there would be long term improvements to water quality resulting from the increased flows (i.e. increased dissolved oxygen levels) as well as changes to the benthic community resulting from the scouring of the former sediment covered stream/river channel. However, similar to Hunts Mill Pond, this section of the river would not be restored to a coldwater system due to the overall warmer water temperatures of the Ten Mile River upstream from Turner Reservoir. The loss of a significant amount of spawning habitat for river herring and shad could result in fewer numbers of these fish entering the marine environment and therefore would not provide any benefits to estuarine and marine fish species that may utilize them for food.

Similar to the two other downstream dams noted above, a large amount of sediment has accumulated behind Turner Reservoir Dam. This sediment has been tested, and found to contain elevated levels of several metals, including cadmium, lead, copper and zinc. Many of these metals are at levels above those where biological effects would be expected to occur in sensitive aquatic life. In addition, some of these metals are in concentrations that are above cleanup standards for some states. Therefore, it will be necessary to dredge this sediment and dispose of it in an appropriate disposal site prior to dam removal in order to prevent it from contaminating any downstream areas of the Ten Mile River. This would increase the cost of the proposed fish passage project beyond the scope of the available resources to implement it. In addition, the 297-acre Turner Reservoir/Central Pond complex is a significant recreational resource as well as a potential emergency water supply for the city of East Providence. It is heavily used by recreational fishers and boaters, and a moderately used walking trail runs along the East Providence side of Turner Reservoir. Dam removal would cause this resource to be lost. Therefore, the State and the City have eliminated the removal of the Turner Reservoir Dam from the possible alternatives for restoring fish passage to the Ten Mile River.

In summary, removal of dams at Omega Pond, Hunts Mill Pond and Turner Reservoir would effect water quality, hydrology, terrestrial wildlife, reptiles and amphibians, riverine processes and sediment chemistry, wetlands, fisheries, essential fish habitat, historic and archeological resources, and cultural and economic resources as discussed above. Based on these effects, existing and potential uses, public opinion, and historic and archaeological concerns, this alternative was eliminated as a reasonable/implementable restoration alternative.

C. Construction of Fishways

In this alternative, a concrete Denil fishway would be constructed at each of the three dams. This would open up a riverine migratory corridor extending approximately three miles from Omega Pond Dam to Turner Reservoir, and an additional mile from Turner Reservoir/Central Pond to the Golf Club Dam in Pawtucket, Rhode Island. In addition, anadromous alewives, which spawn in slower moving waters of rivers, and in lakes and ponds, would have unimpeded access to approximately 340 acres of lake spawning habitat in Omega Pond, Hunts Mill Pond, and Turner Reservoir.

1. Omega Pond Dam

In this alternative, a 4-foot wide concrete Denil fishway would be constructed adjacent to the left abutment of the spillway to provide upstream fish passage (see Plates 1 and 2 in the Detailed Project Report). The entrance channel to the fishway would be 30-inches wide and situated at the base of the spillway at a 45-degree angle to the direction of flow. The fishway would then widen to 4 feet as it turns 135 degrees. After a 10-foot level section, the fishway would ascend parallel to the spillway/bridge abutment for a length of 42.5 feet. At the top of this lower leg of the fishway, the fishway turns 180 degrees at a 10-foot long turning/resting pool. From this point, the fishway would ascend an additional 57.5 feet to an 8.5-foot long exit channel into Omega Pond. The exit channel would be cut into the existing stone spillway. For downstream passage, a 3-foot wide by 1-foot deep downstream migrant slot would be cut into the spillway about 20 feet from the left abutment. Due to the stepped downstream face of the spillway, a smooth surface flume and plunge pool would also be included to provide safe passage for juveniles.

With the proposed fish ladder, up-migrating fish would be allowed free access to areas upstream of Omega Dam, which includes the approximately 2 miles of riverine habitat upstream from Omega Pond as well as the 33 acres of lacustrine habitat in Omega Pond. During periods of upstream migration, Denil baffles would be installed and water would be allowed to flow through the fishway by opening the stop log control structures at each end of the fishway. This would enable fish to migrate through the fishway. A fishway of this size could potentially pass between 250,000 and 400,000 river herring and about 25,000 shad.

2. Hunts Mill Dam

For this alternative, a similar fishway structure would be constructed at Hunts Mill Pond, but it would be located adjacent to the right end of the dam, and include a fish trap (see Plate 4 in the Detailed Project Report). The exit of this concrete Denil fishway and fish trap would fit into the existing headworks structure adjacent to the right end of the concrete spillway. The remainder of the fishway would continue past this structure along the right bank and then turn back to its entrance at the base of the spillway. After the entrance channel widens from 30-inches to 4 feet and turns 135 degrees, the fishway ascends 35 feet parallel to the riverbank. The fishway then turns 180 degrees at a 10-foot turning/resting pool, and ascends an additional 32.5 feet before entering a 10-foot level section. This is followed by an 8-foot wide by 10-foot long fish trap with lifting brails to facilitate the transfer of fish. The exit channel from the fish trap would be 3 feet wide. The fish ladder would allow anadromous river herring and shad access to an additional 10 acres (0.5 river miles) of lacustrine spawning and nursery habitat in Hunts Mill Pond, extending to the base of Turner Reservoir Dam. The fishway ladder would be operated in a similar fashion as the one proposed at Omega Pond Dam, and during the same time

period. This would allow up-migrating river herring and shad to continue their migration to the base of Turner Reservoir Dam.

3. Turner Reservoir Dam

In this alternative, upstream passage would be provided by a 4-foot wide concrete Denil fishway that would be placed adjacent to the left abutment of the concrete spillway (see Plate 8 in the Detailed Project Report). The entrance to the fishway would be situated in the stilling basin at the base of the spillway. As the inlet faces downstream at a 45-degree angle, the fishway makes a 135-degree turn before ascending 47.5 feet to a 10-foot turning pool. The upper sloping leg of the fishway is 60 feet long and terminates at an exit channel about 11 feet long. This exit channel would be cut into the spillway about 1.1 feet. During periods of upstream migration, the fishway would be operated concurrently with the fishways at Hunts Mill and Omega Pond. Downstream passage would be provided via a 3-foot wide by one-foot deep notch in the spillway. This notch would be situated about 19 feet from the left spillway abutment.

Construction of a fishway at Turner Reservoir will enable up-migrating anadromous fish on the Ten Mile River to continue their migration from areas above the lower two dams to expansive spawning areas above this dam. This includes approximately 297 acres of lacustrine spawning habitat within Turner Reservoir for anadromous alewives, and about a mile of riverine habitat upstream from the reservoir. The Rhode Island Department of Environmental Management has estimated that providing anadromous fish passage at the lower three dams on the Ten Mile River would support a run size of about 205,000 river herring.

D. Other Fish Passage Alternatives

Advantages of a fishway compared to a fish lift include the ability to allow fish to passively migrate upstream without the need for manual operation. Most fish lifts are operated periodically at various times during the day, and rarely at night. This requires up-migrating fish to wait at the lift gates until they are opened for transport. This can create less than optimal conditions since the fish can become crowded during the waiting period subjecting them to increased predation as well as a number of other stress factors. These can include temporarily exceeding the dissolved oxygen capacity of the area where the fish are being held; aggressive behavior such as fin nipping and an increase in activity (as the fish attempt to adjust to the crowded conditions) further increasing the dissolved oxygen demand; and scale abrasion. These stress conditions can have long term effects by lowering the fish's resistance to disease and/or generally weakening the fish, particularly where there has been scale abrasion and fin wounds (i.e. infection). Although the extent of the crowding may not be significant during most transport operations, the fact that crowding is inherent in fish lift operations is another disadvantage of manual lifting compared to passive migration provided by a fishway or other means (dam removal). This type of crowding would be significantly reduced with

the construction of a fishway, allowing up-migrating fish to freely move upstream through the fishway.

Limitations to fishway alternatives include the fact that fishways are generally 70%-90% efficient at passing shad and river herring when compared to having no dam in place. Therefore, construction of a fishway ladder would not be as effective as complete dam removal in allowing unobstructed upstream and downstream fish migration in that section of the Ten Mile River. Other associated benefits that would be provided by dam removal, such as restoration of the historic riverine habitat (consisting of riffles, runs and pools), would also not be realized. However, the existing lacustrine habitat and its associated warmwater fishery, as well as the extensive riparian and wetland areas that surround the existing impoundments would remain. In addition, the municipal and recreational resources associated with these impoundments, particularly Turner Reservoir, would be maintained. As noted, Turner Reservoir/Central Pond is heavily used by recreational fishers and boaters, as well as visitors who use the pond for passive recreation. Therefore, the alternative of a fishway ladder as opposed to removal of the dam would have the benefit of fish passage while still allowing the reservoir to remain in place for other usage.

VI. Affected Environment

A. General

The Omega, Hunts Mill, and Turner Reservoir Dams are located in the city of East Providence within the four-mile reach of the Ten Mile River that extends from its confluence with the Seekonk River (tidewater) to Turner Reservoir. These dams and ponds characterize and define the entire reach of the river as it flows through the city of East Providence. The area is primarily urban/industrial, however, much of the land bordering the river and its impoundments is either residential or used for public recreation, particularly the areas surrounding Turner Reservoir and Hunts Mill Dam. Access to the general area is via Routes I-95 and I-195, which cross the Providence River connecting Providence to East Providence and Seekonk, Massachusetts. In addition, U.S. Route 44 runs through the City continuing through from Massachusetts to Connecticut and linking with state Routes 114 and 152. Access to Turner Reservoir is primarily via Route 152, which divides Turner Reservoir. Turner Reservoir itself lies on the border between East Providence, Rhode Island, and Seekonk, Massachusetts. Omega Pond and Hunts Mill Dam are located downstream from Turner Reservoir and are accessible from these same routes and connecting roads.

B. Terrestrial Environment

1. Topography

The 540 square-mile watershed of the Ten Mile River extends from sea level in the area of East Providence, through moderately flat terrain along its 21 miles, rising approximately 250 feet to its headwaters in Plainville, Massachusetts. The area is characterized by gently rolling small hills of glacial origin. Elevations within the watershed range from at or near sea level, to approximately 450 feet at Red Brush Hill in Plainville, near the headwaters of the river. The two major tributaries, the Bungay and the Sevenmile Rivers rise to elevations of approximately 180 feet each near their respective headwaters. The city of East Providence is relatively flat, with the elevation gain of the river being approximately 40 feet between the outflow at Omega Pond Dam and Turner Reservoir. From its headwaters to its mouth, the river flows through numerous ponds and lakes most of them artificially created by dams. Major land usage within the watershed ranges from approximately 52% forest, 18% residential, and 14% industrial, in the section between Cargill Pond and West Bacon Street in Plainville, to approximately 39% forest, 34% residential and 9% open land in North Attleboro. East Providence itself is primarily residential and industrial, with approximately 5% open land, with approximately half of it owned by the City.

2. Geology and Soils

The Ten-Mile River Basin is underlain primarily by sedimentary rock of paleozoic and precambrian origin. The upper section contains igneous and meta-sedimentary rock from the same period. The surficial geology is characterized by features resulting from the glacial recession, with the bedrock being overlain primarily by sands and gravels as well as glacial till. The areas in the immediate vicinity of the river and its tributaries are overlain by flood plain alluvium.

3. Vegetation

The Ten Mile River basin lies in the southeast corner of Massachusetts, with the lower 6 miles extending into East Providence, Rhode Island. Vegetation types within the watershed include deciduous forest, evergreen forest, scrub-shrub wetland and agricultural fields. In addition, the Ten Mile River, as well as its two major tributaries, the Sevenmile and the Bungay rivers, are associated with large areas of emergent and aquatic bed wetlands along their courses. Many of the impoundments along these rivers contain large areas of fringing scrub-shrub and emergent wetland vegetation. Near the headwaters, the area is characterized primarily by deciduous forest, including stands of oak, maple, birch and ash, with some small stands of evergreen forest, consisting primarily of white pine, red pine and hemlock.

Wetland vegetation includes red maple wetlands, and willow, alder, dogwood, witch hazel and sweet pepperbush in scrub-shrub areas. Emergent vegetation closer to the ponds and tributaries include cattail (*Typha* sp.), sedges (*Carex* sp.), skunk cabbage

(*Symplocarpus foetidus*), and pickerelweed (*Pontederia* sp.). Aquatic bed vegetation present in the various ponds and impoundments can include water lily (*Nuphar* sp.), bladderwort (*Utricularia* sp.) and pondweed. Before flowing into East Providence, the river flows through Ten Mile River State Park, which is a forested recreational area with hiking trails, and facilities for picnicking and other activities. The area also contains large areas of wetland, with scrub shrub, emergent and aquatic bed vegetation.

In the immediate vicinity of the project sites at Omega Pond, Hunts Mill and Turner Reservoir, vegetation types vary as a result of residential and industrial development. Turner Reservoir (as noted earlier) is bordered by a combination of residential and wooded land, most of it upland with the exception of a large section of emergent and scrub-shrub wetlands associated with the inflow of the Ten Mile River where a large delta has formed. Predominant emergent vegetation in this area consists of cattail with sedges, with the surrounding upland throughout the remaining area of the pond vegetated with a combination of mixed hardwoods and smaller shrubs. Under-story throughout this area includes abundant stands of poison ivy and staghorn sumac. These vegetation types continue through the small pond at Hunts Mill and Omega Pond. In addition, large willows are present in the embankments bordering Omega Pond.

4. Wildlife

The semi-urban location of Omega Pond, Hunts Mill and Turner Reservoir limits the types and numbers of terrestrial wildlife species to those that can exist in close proximity to areas of human population. These include smaller mammals such as gray squirrel, eastern chipmunk, woodchuck, striped skunk and raccoon. In local areas with less population density and areas of the upper watershed, mammalian species (in addition to the above) can include muskrat, beaver, river otter, cottontail rabbit, white tailed deer, red fox, gray fox, and coyote. The above listing includes the more common mammals that have been found within the Ten-Mile River Watershed. The Commonwealth of Massachusetts, Division of Fisheries and Wildlife's Mammals List, 4th Edition (Cordoza et al, 1999), contains a comprehensive listing of mammals that can be found within the state of Massachusetts; the same list would apply to Rhode Island.

Avian species within the watershed area are those that are common to the various upland, forested and wetland habitats of the state, including both over wintering and summering migratory birds and waterfowl.

Many avian species, such as herons, loons, and raptor species, as well as terrestrial mammals such as river otter and to a lesser extent raccoons, that are pisciverous, have been found in the Ten Mile River Watershed. Turner Reservoir, and to a lesser extent Hunts Mill and Omega Pond, provide habitat to large numbers of waterfowl including mallard ducks, Canada geese, as well as domestic ducks, geese and swans. These birds have become extremely prolific in Turner Reservoir, and are likely contributing to the less than ideal water quality of the reservoir through their droppings. During the Corps' 1999 study of Turner Reservoir, large amounts of goose droppings littered the shore of the reservoir in areas adjacent to Route 152.

5. Reptiles and Amphibians

The watershed of the Ten Mile River provides habitat for various reptile and amphibian species. Amphibian habitat is provided by vernal pools within the watershed, wetlands surrounding the numerous impoundments, and the area of emergent and scrub/shrub wetlands at the inflow of the Ten Mile River to Turner Reservoir. Generally, the amphibian species that can be found in these areas include many of the frogs and toads common to the states of Massachusetts and Rhode Island, such as American toad, spring peeper, grey tree frog, green frog, wood frog, and pickerel frog. Common salamanders that may be found in the watershed include spotted, two lined and redback salamander.

Reptiles common to the watershed include turtles and snakes, which inhabit many of the freshwater ponds and wetlands as well as some of the wooded upland areas (i.e. snakes). Turtle species common to the watershed include common snapping turtle, stinkpot turtle, spotted turtle, eastern painted turtle, wood turtle, and eastern box turtle. Snakes common to the watershed include the eastern garter snake, hognose snake, northern water snake, milk snake, northern brown snake, eastern ribbon snake and northern ringneck snake. Most of these are upland /terrestrial species, and therefore are not found in the wetland and/or aquatic habitats of the river itself, but in adjacent areas.

C. Aquatic Environment

1. Hydrology

The Ten Mile River flows for a distance of approximately 21 miles from its headwaters in Plainville Massachusetts, to tidewater in East Providence, Rhode Island. The total watershed area is approximately 56 square miles. The average annual discharge is approximately 104 cubic feet per second (cfs) with average monthly flows ranging from 47 cfs in July, to 182 cfs in March (as recorded since 1986 at USGS gage 01109403 at Pawtucket Avenue in East Providence, RI). The entire watershed provides approximately 2 billion gallons per year of groundwater to the surrounding communities, and 1.6 billion gallons of water per year of surface water. Surface water sources within the watershed include the mainstem of the Ten Mile as well as its two major tributaries, (the Sevenmile and the Bungay Rivers). In addition, there are approximately 45 ponds in the watershed, forming 1,296 surface acres of water. There are many other smaller tributaries in addition to the Sevenmile and Bungay Rivers along the 21-mile course of the Ten Mile River.

Numerous dams (with impoundments) are present along the river and its tributaries. There are at least 14 additional ponds upstream from Turner Reservoir on the Ten Mile River, most of them formed by dams. These dams were built during the last 100-200 years for process water and hydropower for many of the industries that developed along the river corridor. The Sevenmile and Bungay Rivers also flow through numerous ponds that have been formed by dams. Many of these impoundments are

used as drinking water supplies for adjacent towns. The North Attleboro National Fish Hatchery is located on the headwaters of the Bungay River, which holds sea run Atlantic salmon for spawning, incubates eggs, and produces fry for Atlantic salmon restoration.

In addition to the two major tributaries to the Ten Mile River, the Sevenmile and Bungay rivers, numerous other smaller streams flow into the Ten-Mile River. Many of these flow through various wetlands, ponds and impoundments. These include Scotts Brook in North Attleboro and Thatcher Brook in Attleboro.

2. Water Quality

The Ten Mile River has been designated as Class B, Warmwater Fishery, High Quality from the source waters in Plainville, to the Whiting Dam, and Class B, Warmwater Fishery, from the Whiting Dam to the state line by the Commonwealth of Massachusetts Department of Environmental Protection (DEP) according to the Massachusetts Surface Water Quality Standards. These standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996). It should be noted that these standards are designations for a specific use, and do not necessarily indicate that the water at a given location is meeting these standards. They are rather a goal for a specific water body for which it should be maintained.

Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

Within the aquatic life use category, there are three subclasses: (1) Cold Water Fishery - waters that are capable of sustaining a year-round population of cold water aquatic life such as trout; (2) Warm Water Fishery - waters not capable of sustaining a year-round population of cold water aquatic life; and (3) Marine Fishery - suitable for sustaining marine flora and fauna. Based upon these criteria, the Ten Mile River does not have any area with water temperatures cold enough to support a year round population of coldwater fish (i.e. trout or salmon). However, there are some individual segments where there is evidence of natural reproduction of trout species (Ten Mile River Basin 1997 Water Quality Assessment Report).

The Ten Mile River enters Rhode Island in East Providence, and flows through the Ten Mile Reservation, and into Turner Reservoir. The river is designated Class B by the Rhode Island Department of Environmental Management (RIDEM), Division of Water Resources, from the Newman Avenue Dam, including Turner Reservoir to its confluence with the Seekonk River below Omega Pond (tidewater). As noted previously, these water quality designations are goals, and do not necessarily mean that a water body is meeting a particular designation. Sections of the Ten Mile River upstream from Turner

Reservoir as well as the reservoir itself are on the state of Rhode Island's list of impaired waters (303(d) List), having elevated levels of lead, copper, phosphorus, and coliform bacteria, as well as low dissolved oxygen levels.

2a. Historical Water Quality Surveys

Historical water quality data collected by RIDEM from Turner Reservoir has indicated elevated levels of nutrients (i.e. nitrate, phosphorus) ammonia, coliform bacteria, Biological Oxygen Demand (BOD) and possibly lead. Also, in 1984, the Ten Mile River was surveyed by Rumford River Laboratories, and a report was prepared in 1985 (Toward a Cleaner Ten Mile River). It found that "the overall condition of the river had improved markedly in the last decade due to better treatment of industrial and municipal wastewaters. However, problems remained with two major aspects: Metal contamination by copper, lead and nickel, and over-fertilization of aquatic vegetation by phosphate nutrients. There were abnormally high concentrations of metals in the river and large residuals of metals in the sediments of the impoundments, eliminating normal bottom organisms. The adverse impacts of these metals were seen at all levels in the aquatic organisms and fish. Copper and nickel in the river system came from industrial discharges, while lead came from industries, roadways and other sources. There were problems with ammonia, excess chlorine and other chemicals lethal to aquatic life, from some of the wastewater treatment plants."

In 1999, the U.S. Army Corps of Engineers conducted an investigation of Turner Reservoir, and also found elevated levels of nutrients (i.e. nitrogen and phosphorus). Water samples collected at the inflow to the reservoir on September 3, 1999 had nitrate and total phosphorus levels of 6.4 mg/L and 0.16 mg/L respectively. These levels exceed EPA water quality criteria for the prevention of algal blooms and eutrophication (0.3 mg/L for nitrate and 0.025 mg/L for total phosphorus). In addition, sediment sampling indicated elevated levels of several metals, including zinc, nickel, copper, as well as chromium and cadmium. Many of these levels exceeded biological effects levels for sensitive aquatic life. This data is published in the Turner Reservoir Study, East Providence, Rhode Island, dated February 2001. These data were in general agreement with historical data noted earlier, which indicated nutrient enrichment as well as elevated levels of several metals.

This study also included measurements of temperature, pH, conductivity and dissolved oxygen from several locations at various depths. All of the parameters measured were at acceptable levels for survival of most warmwater fish species, as well as other aquatic life. However, conductivity levels ranged between 553 micro-siemens/centimeter (uS/cm) to 865 uS/cm, which although not necessarily harmful to aquatic life, indicate high ionic concentrations most likely associated with the elevated nitrate and other nutrient and metals levels. Generally, conductivity levels of many man-made lakes in New England (i.e. Corps of Engineers Projects) have conductivities ranging from 60 uS/cm to 300 uS/cm. These are about half of those measured at Turner Reservoir. This data is presented in Table 1.

A large amount of duckweed has been documented along the shores of Turner Reservoir. In some locations the mat extended approximately 20 or more feet from the shore, completely obliterating the open water in these areas. Generally, duckweed is an indication of nutrient enrichment, and confirms the high phosphorus and nitrate concentrations found in Turner Reservoir and Central Pond. The dense duckweed growth observed in Turner Reservoir during the summer of 1999 created an offensive odor, which occurred when the plant material died and decomposed along the shore of the impoundment.

Sources of water quality impairment on the lower Ten Mile River include nutrients from wastewater treatment discharges upstream in Attleboro, and non-point sources such as road runoff and fertilizers from lawns. In addition, some of the sediment contamination is the result of historic industrial discharges into the river prior to the implementation of the water quality standards required by the Clean Water Act. As noted, the Ten Mile River is significantly cleaner now than it was in the 1960's.

Table 1. Water Quality Data Collected from Turners Reservoir/Central and North Pond on 9 September 1999 by the U.S. Army Corps of Engineers.

Station	Depth	Temp.	DO	DO % Sat	pH	Cond. (uS/cm)
Ten Mile River Inlet	2	19.3	6.1	66	7.5	865
North Pond	1	21.2	8.9	100	9.0	683
	3	21.0	7.5	84	8.9	673
Central Pond 1	1	22.2	10.9	125	8.9	674
	5	21.9	11.6	127	8.9	680
Central Pond 2	2	22.1	9.6	110	8.8	659
	7	21.8	6.0	66	8.6	672
Route 152	2.5	22.2	10.5	121	8.9	636
South Pond	2	22.5	11.0	126	9.3	609
	5.5	22.0	9.4	108	9.1	603
	9	21.8	5.1	56	8.2	633
Reservoir Discharge	1	21.7	10.3	117	9.3	553

Although historical water quality data is not available for Omega Pond, it is presumed to be similar to that of Turner Reservoir, being only two miles downstream from the outflow of Turner Dam. Omega Pond also shows signs of enrichment, with similar mats of duckweed present along the shoreline observed during the summer of 2001. Similar to Turner Reservoir, Omega Pond supported a warmwater fishery indicating that the basic water quality criteria necessary to support aquatic life were being met.

3. Riverine Processes and Sediment Chemistry

Sediment transported downstream in the Ten Mile River during normal flow settles out behind each of the many dams along its 21-mile course. During extremely high flows, some of this can remain suspended and is carried further downstream, either to the outflow of Omega Pond, or to settle out behind one or more of these dams, including Turner, Hunts Mill, and Omega. The sediments in the Ten Mile River including those that have accumulated behind many of the dams, have been found to contain elevated levels of several metals including copper, zinc and cadmium (at Turner Reservoir). The sediment samples that were collected at Turner Reservoir during the summer/fall of 1999 were found to have concentrations of metals above the severe biological effects levels established by the Ontario Ministry of the Environment (OME) for chromium, nickel, copper, zinc, cadmium and lead as well as the Long and Morgan Biological effects levels. The historic industrial discharges upstream from Turner Reservoir as well as the other dams are believed to be the sources of the elevated metals concentrations in the sediments. Wastewater treatment facilities from some of the upstream communities have also added additional contaminants. These data are summarized in Table 2.

Sediments collected in Omega Pond and Hunts Mill Pond also had elevated concentrations of metals as well as other contaminants (see Appendix F). Generally, for the specific metals that were sampled in all three locations (Turner Reservoir, Hunts Mill Pond and Omega Pond), the levels from both Omega Pond and Hunts Mill Pond were lower than those from the sediments in Turner Reservoir, with the exception of lead, which was higher in Omega Pond than in Turner Reservoir. Levels of chromium, nickel, copper, zinc, and cadmium in the sediments of Omega Pond were generally one half of the concentration of the sediment in Turner Reservoir, but they were still above many of the levels where biological effects would occur in the life stages of sensitive aquatic organisms (i.e. Long and Morgan ER-L and ER-M as well as the Ontario Ministry of the Environment Levels for both the LEL and SEL). Lead levels in sediments from Omega Pond were generally higher than those from both Turner Reservoir and Hunts Mill Pond, with the highest concentration (from site 4) being 514 ppm, compared to the highest concentration of 401 ppm collected from Turner Reservoir. In contrast, the sediment lead levels in Hunts Mill Pond ranged between 71 ppm and 82 ppm.

In the absence of additional point or non-point sources of metal contamination downstream from Turner Reservoir, it could be assumed that the general reduction in sediment contaminant levels in both Hunts Mill and Omega Ponds could be due to the successive settling out of these materials behind the dams, with most of it settling at Turner, and the remaining settling out in the successive downstream areas. The fact that Hunts Mill Pond sediments generally contained the lowest levels of most of the contaminants could be due to it being the lowest dam and therefore providing the least amount of depth for sediment to collect. Most suspended sediments would therefore be carried over the dam and continue downstream to Omega Pond.

Table 2. Concentrations of Metals in Sediment Collected at Turner Reservoir, September 1999 by the U.S. Army Corps of Engineers.

	Turner Reservoir, East Providence Rhode Island																	
	Concentrations of Metals in Sediments																	
						(concentrations in µg/g dry weight - not blank corrected)												
Sample Description	**Sample Wet Wt. (g)**	**Sample Dry[a] Wt. (g)**	**Moisture (%)**	**Cr ICP-MS**		**Ni ICP-MS**		**Cu ICP-MS**		**Zn ICP-MS**		**As ICP/MS**		**Cd ICP-MS**		**Pb ICP-MS**		**Hg CVAA**
Location																		
Central Pond	94.26	12.704	86.52	407		564		1350		731	B	11.3		80.9		262		1.55
Turners's Reservoir Site 3	105.77	28.269	73.27	350		1050		1400		678	B	6.54		71.9		176		1.68
Turners's Reservoir Site 2	88.46	12.395	85.99	897		1750		2710		1500	B	13.5		157		401		3.33
Long and Morgan																		
Biological Effects Levels																		
ER-L				**80.0**		**30.0**		**70.0**		**120**		**33.0**		**5.0**		**35**		**0.2**
ER-M				**145.0**		**50.0**		**390.0**		**270**		**85.0**		**9.0**		**110**		**1.3**
Ontario Guidelines (OME)																		
Effects Levels																		
LEL				**26.0**		**16.0**		**16.0**		**120.0**		**6.0**		**0.6**		**31.0**		**0.2**
SEL				**110.0**		**75.0**		**110.0**		**820.0**		**33.0**		**10.0**		**250.0**		**2.0**

It is presumed that most of the contaminants in the sediments are the result of sources in the Ten Mile river upstream from Turner Reservoir, however, the higher lead levels in Omega Pond may also be due to industrial discharges and urban runoff into Omega Pond**.**

In addition to the high sediment metal concentrations in both Hunts Mill Pond and Omega Pond, detectable levels of several organochlorine pesticides were detected. Levels of 4'4' DDE, 4'4' DDD and 4'4' DDT were elevated in the sediments of both Omega Pond and Hunts Mill Pond, (as well as in Turner Reservoir as reported from the 1999 sampling). Generally, levels of some of these contaminants were higher in Omega Pond than those found in both Hunt's Mill Pond and Turner Reservoir. A level of 146 ppb of 4'4' DDD was detected at site 7 in Omega Pond, which is approximately 10 times the highest level of 13.30 ppb found in Turner Reservoir with none detected at Hunts Mill Pond. Levels of 4'4' DDT from Omega Pond Site 7 were also higher than those collected from Hunts Mill Pond and Turner Reservoir, with a concentration 101 ppb detected at Omega Pond site 7, compared with 4.85 ppb measured at Turner Reservoir and none detected at Hunts Mill Pond. It should be noted however that levels of 4'4 DDE were higher in Turner Reservoir than in Omega and Hunt's Mill Ponds, measuring 60.50 ppb in Turner Reservoir, 44.2 ppb in Omega Pond, and a maximum of 10.4 ppb at Site 3 at Hunts Mill Pond. These levels in Omega Pond and Turner Reservoir exceeded both the ER-L and the ER-M (Long and Morgan) biological effects levels of 2 ppb and 15 ppb respectively where effects to specific life stages of sensitive organisms can be expected, with the levels in Hunts Mill Pond exceeding the ER-L. These data are presented in Appendix F. If dam removal was to be considered as an option for fish

passage at one or more of these dams, then these sediments would need to be either removed or otherwise stabilized to prevent them moving into the Seekonk River estuary downstream and contaminating these areas as well.

D. Biological Resources

1. Aquatic Vegetation/Wetlands

Areas of emergent wetland in the Ten Mile River within the project area (i.e. Turner Reservoir/Central Pond, Hunts Mill Pond and Omega Pond) occur within the fringing shorelines, as well as along the margins of the riverine corridor connecting them. In Turner Reservoir/Central Pond, an extensive area of emergent and scrub-shrub wetland is located at the inflow of Ten Mile River to the reservoir, where a vegetated delta has been created by sediment deposition. Additional wetlands can be found along the margins of the impoundment, particularly in several shallow coves. Also, several smaller water bodies that are hydraulically connected to the reservoir by small streams or inlets contain wetlands. Predominant wetland types include aquatic bed as well as lacustrine emergent, with major wetland vegetation species being cattail, yellow water lily, sedges, pickerelweed, and willow.

The Ten Mile River flows through numerous areas of associated wetlands on its course from Plainville, MA, through to tidewater. Many of these are associated with the impoundments that have been artificially created by the dams, although there are many which fringe the riverine corridor. Among these are the areas of Ten Mile River Reservation and Ten Mile River State Park in East Providence and Pawtucket, Rhode Island. Within the Ten Mile River Watershed, additional wetlands occur along both the Sevenmile and Bungay Rivers.

At all three locations, wetland vegetation is limited to small areas along the edges of the riverbank, with very little contained in the construction area footprints. At Turner Dam, the river cascades onto a concrete walled rocky channel, which extends approximately 25 feet downstream from the dam as it approaches Hunts Mill Pond. This precludes the establishment of a large amount of wetland vegetation. The channel beyond this point is characterized by moderately sloped banks, which ascend to upland within a short distance from the edge of the river. A similar situation exists at Hunts Mill Dam, where the channel downstream consists of rocky substrate with naturally occurring bedrock banks which slope down to the river from the adjacent upland.

At Omega Pond Dam, the river discharges onto a granite base as it enters tidewater. Two concrete headwalls extend approximately 50 feet from the spillway channeling the river. These preclude the establishment of significant amounts of estuarine wetland vegetation, however there are estuarine wetlands along the margins of the Seekonk River into which the Ten Mile River flows.

2. Fisheries

2a. The Ten Mile River Watershed

The Ten-Mile River is designated as Class B, warmwater fishery from its headwaters in Plainville Massachusetts, to the Rhode Island border by the Commonwealth of Massachusetts, Division of Fisheries and Wildlife. This Class B designation (by RIDEM) continues for the Ten-Mile River from the Newman Avenue Bridge (at Turner Reservoir), to its confluence with the Seekonk River in East Providence. The designation of warmwater fishery in Massachusetts indicates that generally the water temperatures in the river are too warm to sustain year round populations of coldwater fish (i.e. trout, salmon). Although the water temperature of the Ten Mile River is considered too warm to support naturally reproducing trout populations, the river is stocked with trout in the spring by the Massachusetts Division of Fisheries and Wildlife in order to provide a put and take trout fishery. There are also some sections of the river where year round populations of trout have been sustained as indicated by the presence of natural reproduction. These include some of the areas upstream near the headwaters of the river.

The numerous ponds and impoundments that are located along the course of the river provide fisheries habitat to many warmwater fish species. These include chain pickerel, redfin pickerel, largemouth bass, bluegill, yellow perch and white sucker. These impoundments can also raise water temperatures in the river, thereby perpetuating the warmwater fish habitat (to the exclusion of potential coldwater habitat). This occurs when the inflowing water is held, allowed to warm and then released downstream. Therefore, it is presumed that historical coldwater fish habitat has been changed to warmwater fish habitat by the construction of these dams and their resulting impoundments. Also, according to the previously referenced 1985 study by Rumford River Associates, many of these upstream impoundments appear to have been impacted by the historically poor water quality. This was indicated by the lower species diversities found in several of these ponds, compared to others either downstream or upstream from them.

2b. Turner Reservoir and Central Pond

The section of the Ten Mile River in the vicinity of Turner Reservoir and the downstream sections of the Ten Mile River, as it flows through to tidewater, support a warmwater fishery. Both RIDEM and the U.S. Army Corps of Engineers have conducted fisheries surveys of Turner Reservoir and Central Pond. These surveys indicated the presence of a typical warmwater fish assemblage. Species collected included yellow perch (*Perca flavescens*), white perch (*Marone americana*), largemouth bass (*Micropterus salmoides*), white sucker (*Catostomos commersoni*), bluegill (*lepomis gibbosus*), pumpkinseed (*Lepomis macrochirus*), yellow bullhead (*Ameiurus natalis*), golden *shiner* (*Notemegonus chrysoleucus*), American eel (*Anguilla rostrata*), and black crappie (*Pomoxis nigromaculatus*). Those fish that were collected in 1999 are listed in Table 3.

Table 3. Listing of all fish species captured at Turner Reservoir (including Central Pond) during the summer of 1999 (by electrofishing)[1] by the Corps of Engineers

Species	Scientific Name	Total Collected	Percent Catch	Percent Weight
Bluegill	*Lepomis macrochirus*	41	14.39	7.52
Eel*	*Anguilla rostrata*	2	0.70	
Largemouth Bass	*Micropterus salmoides*	118	41.40	52.21
Pumpkinseed	*Lepomis gibbosus*	52	18.25	10.78
White Perch	*Morone americana*	7	2.46	4.50
White Sucker	*Catostomus commersoni*	4	1.40	12.37
Yellow Bullhead	*Ameiurus natalis*	2	0.70	2.36
Yellow Perch	*Perca flavescens*	58	20.35	9.30
Black Crappie	*Pomoxis nigromaculatus*	1	0.35	0.97

[1] An additional 46 white perch were also collected by gillnet, not included in above table.

* Eels were not weighed.

The data from the 1999 fisheries survey of Turner Reservoir indicated that largemouth bass were the most abundant species in the combined total collected. In addition, the length frequency distribution of these fish indicated the presence of several year classes (including young of year) with some of the larger fish being in the size class of fish that could range from approximately 7 to 10 years old (49 centimeters) in temperate climates (Carlander, 1977, from USACE, 2001). Also, the largemouth bass that were collected had condition factors (i.e. a measure of weight/length relationship, indicating the overall robustness of the fish) that were comparable with those from other New England lakes that have healthy largemouth bass populations. This would generally indicate the presence of a suitable food supply (forage base) to sustain these fish. Although the condition of these fish indicated sufficient forage in the lake, relatively few of the common forage species (such as golden shiner and white sucker) preyed on by largemouth bass were collected. This suggests that the largemouth bass in Turner Reservoir and Central Pond may be relying on species such as young bluegill, pumpkinseed and yellow perch as their primary food source. Therefore, the reestablishment of anadromous alewives and shad would further benefit the ecosystem by providing additional forage for the existing largemouth bass population, as well as other predator game species (black crappie) in the reservoir.

Additional fisheries data were also collected by RIDEM from Turner Reservoir and Central Pond during April of 2001. For Turner Reservoir, the species collected were the same as in the 1999 sampling with the exception of American eel, a single goldfish and two white catfish that were found in the 2001 sampling. In addition, the predominant species caught in 1999 was largemouth bass, whereas in 2001 it was white perch. However, the largemouth bass collected were generally larger than those collected in 1999. This may be due to the fact that the lake was sampled in April before largemouth bass spawning season, and therefore the sample did not have the large numbers of young of year that generally predominate in the summer. These data are presented in Table 4.

Table 4. Fish species collected from Turner Reservoir in April 2001 by the Rhode Island Department of Environmental Management (RIDEM).

Species	Scientific Name	Number Collected	Mean Total Length (cm)	Length Range (cm)
White Perch	*Marone americana*	206	22.3	18.6-25.5
Bluegill	*Lepomis macrochirus*	98	14.9	3.7-21.3
Pumpkinseed	*Lepomis gibbosus*	94	14.0	4.5-19.3
Yellow Perch	*Perca flavescens*	43	16.6	9.4-24.0
Largemouth bass	*Micropterus salmoides*	28	29.9	16.5-46.2
Black crappie	*Pomoxis nigromaclatus*	4	20.6	19.8-21.1
White sucker	*Catostomus commersoni*	3	41.2	28.0-49.7
White catfish	*Ameiurus catus*	2	28.2	28.1-28.2
Yellow bullhead	*Ameiurus natalis*	1	25.0	
Goldfish	*Carassius auratus*	1	13.2	

Central Pond was also sampled by RIDEM in April of 2001. Species not previously collected in the past samplings of Turner Reservoir included golden shiner, of which only one representative was collected. The size range for largemouth bass from this sampling was greater including individuals that were smaller, possibly being from the previous summer's young of year. The most abundant species from Central Pond were yellow perch (Table 5).

Table 5. Fish species collected at Central Pond in April of 2001 by RIDEM

Species	Scientific Name	Number Collected	Mean Total Length (cm)	Length Range (cm)
Yellow Perch	*Perca flavescens*	111	19.3	11.2-27.1
White Perch	*Marone americana*	96	22.4	10.5-26.8
Bluegill	*Lepomis macrochirus*	60	16.0	8.3-20.0
Pumpkinseed	*Lepomis gibbosus*	25	15.1	9.4-19.5
Largemouth bass	*Micropterus salmoides*	17	33.4	8.2-56.2
Yellow bullhead	*Ameiurus natalis*	2	19.9	18.2-21.5
Brown bullhead	*Ameiurus nebulosus*	1	27.0	
Golden shiner	*Notemigonus crysoleucas*	1	21.0	
White catfish	*Ameiurus catus*	1	31.0	

2c. Hunts Mill Pond

Fisheries data was also collected from the section of the Ten Mile River between Turner Reservoir and Hunts Mill Dam by RIDEM during August of 2000. Species

collected were those that were common to Turner Reservoir, and consisted of warmwater species only. Generally a warmwater fish assemblage for this area would be expected since the impoundment created by Hunts Mill Dam extends upstream to the base of Turner Dam. A listing of these species is given in Table 6.

Table 6. Fish species collected between Turner Reservoir and Hunts Mill Dam by RIDEM on August 28, 2000.

Species	Scientific Name	Number Collected	Mean Total Length (cm)	Length Range (cm)
Bluegill	*Lepomis macrochirus*	100	13.4	8.4-20.4
Largemouth bass	*Micropterus salmoides*	85	8.6	4.6-42.5
White perch	*Marone americana*	75	17.4	15.2-18.9
American eel	*Anqguilla rostrata*	65	29.5	13.9-55.0
Pumpkinseed	*Lepomis gibbosus*	34	10.5	7.5-16.1
White catfish	*Ameiurus catus*	15	16.3	6.3-20.8
Golden shiner	*Notemigonus crysoleucas*	13	14.0	9.6-20.3
Yellow bullhead	*Ameiurus natalis*	5	14.5	10.3-16.5

2d. Ten Mile River Upstream From Central Pond (Slater Memorial Park)

Slater Memorial Park is located approximately one mile upstream from Central Pond, and consists of additional wetlands that border the river, a smaller feeder pond that flows into the Ten Mile River, and semi-developed upland. The river in this section was sampled by RIDEM on July 31, 2001. Generally, a warmwater fish assemblage was found, with the exception of 4 tessellated darters, which are characteristic of swift flowing colder streams. This would indicate free flowing riverine habitat in this section of the Ten Mile River. Pickerel were also collected from this site. This species was not found in the lower areas of Turner Reservoir or at Hunts Mill and Omega ponds. A listing of fish species collected in this section is presented in Table 7

Table 7. Fish species collected near Slater Park, upstream from Central Pond, on July 31, 2001 by RIDEM.

Species	Scientific Name	Number Collected	Mean Total Length (cm)	Length Range (cm)
White sucker	*Catostomas commersoni*	39	5.5	3.5-7.5
Largemouth bass	*Micropterus salmoides*	35	9.1	4.2-37.5
Yellow perch	*Marone americana*	35	21.2	16.0-25.3
Yellow bullhead	*Ameiurus natalis*	29	12.9	3.0-23.2
Bluegill	*Lepomis macrochirus*	22	16.7	3.7-20.2
Pumpkinseed	*Lepomis gibbosus*	6	10.0	7.8-14.3
Tessellated darter	*Ethiostoma olmstedi*	4	5.4	4.7-6.0
White perch	*Marone Americana*	3	18.9	16.0-20.5
Redfin pickerel	*Esox americanus americanus*	2	13.3	12.5-14.0

2e. Omega Pond

This approximately 33-acre pond consists of the impoundment behind Omega Dam, located at the confluence of the Ten Mile and Seekonk Rivers (tidewater). Omega Pond was sampled for fish on August 29, 2001 by the U.S. Army Corps of Engineers. A typical warmwater fish assemblage was found which included black crappie, bluegill, golden shiner, largemouth bass, pumpkinseed, yellow perch, and the catadromous American eel. A length frequency distribution of the largemouth bass collected from Omega Pond indicated the presence of several age classes. Lengths of these fish ranged from approximately 9 centimeters (presumed to be 0+ or young of year) to 44 centimeters. These lengths included 0+ (young of year), at approximately 9-10 centimeters, as well as fish that ranged between 34 and 44 centimeters. Based upon existing largemouth bass length data for temperate climates, these larger fish could be between 4 and 9 years old (Carlander, 1977). Generally, this distribution indicates that the basic water quality and/or habitat criteria necessary to support a reproducing population of largemouth bass are being met in Omega Pond. In addition, several juvenile black crappie were collected from this location, although no adult size fish were found. This indicates that there is natural reproduction of black crappie in either Omega Pond, or upstream in the Ten Mile River. Table 8 lists the species collected in Omega Pond during the 2001 sampling.

Several American eels were also collected from Omega Pond during this sampling. Two more eels were collected in Turner Reservoir during the 1999 sampling. This species is catadromous, i.e. spawning in saltwater and returning to freshwater to mature, and then completing its life cycle in saltwater. It is also unique in that the upmigrating juveniles (elvers) are able to pass various obstructions and/or dams by

climbing/swimming over or along wetted surfaces. Therefore, they can be found in many upper impoundments behind dams that obstruct the passage of other migratory species. American eels are predators, feeding on smaller fish as well as invertebrates. The fact that they were collected in both Omega Pond and Turner Reservoir indicates (in addition to their ability to pass upstream from these dams) that habitat criteria, including forage fish (i.e. food supply) are sufficient to support them in this system.

Table 8. Fish species collected at Omega Pond on August 29, 2001 by the Corps of Engineers.

Species	Scientific Name	Number Collected	Mean Total Length (cm)	Length Range (cm)
Bluegill	*Lepomis macrochirus*	27	11.5	3.5-19
Black crappie	*Pomoxis nigromaculatus*	17	4.5	1-7.9
Largemouth bass	*Micropterus salmoides*	12	21.9	8.7-44
Pumpkinseed	*Lepomis gibbosus*	5	11.9	9.6-14
Golden shiner	*Notemigonus crysoleucas*	5	7.6	7.2-8.4
Yellow perch	*Perca flavescens*	4	9.6	7.5-16.1
American eel	*Anguilla rostrata*	3	38.1	33-45
Unknown shiner	----------	3	<1	
White sucker	*Catostomas commersoni*	1	54	

E. Threatened and Endangered Species

Recent coordination (see Appendix A) with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Rhode Island Department of Environmental Management has indicated that no Federally-listed threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service and National Marine Fisheries Service occur in the vicinity of the proposed project on the downstream section of the Ten Mile River, with the exception of occasional transient bald eagles (*Haliaeetus leucocephalus).* Habitat in the immediate vicinity of the proposed project at each of the three dams is marginal.

At Turner Reservoir, most of the area in the footprint of the proposed project consists of concrete headwalls, with rocky boulder/cobble bottom below the cascading falls, with very little aquatic vegetation. Similarly, at Hunts Mill Pond, the footprint of the project also consists of a rock wall with boulder and bedrock substrate. The dam at Omega Pond also discharges between a concrete headwall with concrete base, with minimal habitat value. Therefore, the habitat in these areas of the proposed projects are unlikely to contribute to the support of the transient bald eagles noted above.

F. Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation Management Act strengthen the ability of the National Marine Fisheries Service and the New England Fishery Management Council to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "Essential Fish Habitat", and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The estuarine and marine areas downstream of the Ten Mile River (e.g. the Seekonk and Providence River estuaries) provide Essential Fish Habitat (EFH) for adults and juvenile life stages of winter flounder, summer flounder, windowpane flounder, bluefish, scup, Atlantic mackerel, black seabass, king mackerel, and Spanish mackerel. Although these species do not inhabit the freshwater sections of the Ten Mile River in the locations of the proposed project, they can be affected by construction operations in upstream locations. An EFH Assessment of the potential environmental effects of the proposed construction on this habitat is presented in the Environmental Consequences section of this EA.

G. Historical and Archaeological Resources

1. General

East Providence is composed of several distinctive individual communities including Watchemoket, Kent Heights, Riverside, Rumford, and Phillipsdale. Most of the city's development has occurred since its creation out of the larger township of Seekonk, Massachusetts in 1862. The present project area of Ten Mile River is located within the community of Rumford, the site of East Providence's first major settlement, which dates from 1643. Rumford served as the center of the present-day city until the mid-nineteenth century. The community has been called by a variety of names including Rehoboth, Seekonk Center, and East Providence Center.

The land east of the Seekonk River was occupied by the federation of the Wampanoag Indians. In the 1670's, the Wampanoag inhabited an area that stretched from Pawtucket on the north, to Cape Cod on the east, and south to Newport. Villages were typically small, seasonal campsites situated near bodies of water for most of the year, while in winter settlements were moved inland. The locations of Indian trails were later used for major transportation routes to the present day including Interstate 95, State Routes 114 and 103, and U.S. Routes 44 and 6.

The first settlement of East Providence by Europeans was in 1636 when Roger Williams and his followers founded a new community called "Seacunke" (Seekonk) along the shore of a salt water cove that is today Omega Pond northwest of the current project location. Several months later, Williams and his entourage relocated nearby to what would become the city of Providence. In 1643, Puritans had purchased a tract of land from Massasoit, chief of the Wampanoags encompassing the communities of

Rehoboth and Seekonk, Massachusetts, most of East Providence, and portions of Pawtucket. In 1645 the township's name was changed from Seacunke to Rehoboth.

Agriculture was the main subsistence practice in the early years of the settlement through to the mid-20th Century. Grist mills were constructed along the Ten Mile River shortly after settlement. The first mill was erected at the mouth of the Ten Mile River by Richard Wright, a prominent member of the early community. Shortly thereafter, a second mill was constructed further up the river at what is now Hunts Mill. No traces of buildings from the initial period of settlement remain.

Small-scale industrial pursuits on the Ten Mile River have a long history with grist and saw mills dating from the 17th century. In the early 1800's cotton mills were erected at the head of Seekonk Cove (Omega, later Clyde Mills, ca. 1801) and at Hunts Mill (ca. 1823), and later another cotton mill at the south end of Central Pond. However, the Ten Mile River did not generate sufficient power to support major textile plants as were constructed in other parts of the state by the 1830's. On the other hand, the abundance of open land and proximity to Providence and Pawtucket made the northern portion of East Providence a potential site for industries that did not require large amounts of running water to operate. In 1857, George F. Wilson, owner of the Rumford Chemical Works, relocated his plant from Providence to the town common (known as the Ring) in East Providence. Once the main plant was established, Wilson began to purchase older industrial sites including Hunts Mill in 1877. By the late 1870's, the Rumford Chemical Works owned most of the property fronting the Ten Mile River and along the Seekonk River north of Omega Pond.

By the latter part of the 19th century, additional development occurred at Hunts Mill. A pumping station was erected in 1893 primarily to serve the Rumford Chemical Works and nearby Phillipsdale factories. The Sayles Corporation assumed control of the property and added a picnic ground and small amusement park. This led to the development of the summer tourist industry in East Providence. During this time, East Providence Center ceased to be the appropriate name for the community; instead, "Rumford" which had been used to refer to the area surrounding the chemical works, became identified with the entire area.

2. Project Area

The project area is located within the bounds of the Rumford Historic District (Rhode Island Historical Preservation Commission 1976). This district contains the largest concentration of 18th and early 19th century buildings in the city. The district also encompasses the Ring of the Greene when the settlement was the center of Rehoboth and most of the 19th century village of Seekonk Center (later East Providence) and Hunts Mill, which was an important manufacturing location during these periods. Among the notable buildings are the John Hunt house on Hunts Mill Road, a circa 1770's 2-story, 5-bay Georgian dwelling with center chimney and gable roof (listed on the National Register of Historic Places), and an 1893 pumping station built by the East Providence Fire District consisting of a 1-story stone building with hip roof and large rear stack. The

National Register nomination form for the Rumford Historic District describes the buildings and surrounding grounds at Hunts Mill as "a property of special significance…closely associated with local industrial history and recreational activity [serving] as a mill privilege, amusement park, and waterworks from the seventeenth century until the early 1970's." The Hunts Mill Dam, although modified since its original construction, would be considered a contributing element to the district as a component of the Hunts Mill built environment. The current dam dates from 1849-50 and was likely associated with the establishment of the Rumford Chemical Works.

The Hunt House, home of the East Providence Historical Society, has been renovated and is currently open to the public. Mills have occupied the site of the Hunt House since the late 17th Century. The Hunt family, among the earliest settlers of Rehoboth, MA purchased a gristmill and fulling mill here in 1713. In 1873, the Rumford Chemical Company purchased Hunts Mill. By 1893, the last of the mill buildings were demolished and the 1893 pumping station built to provide water to the Rumford Company and to the new factories in Phillipsdale north of the present study area.

Hunts Mill became a prime recreation area and in 1900, a carousel, picnic grounds, and dance hall were constructed and comprised the Hunts Mill Amusement Park. The Ten Mile River was dotted with canoe houses and refreshment stands all the way to Omega Pond. In 1925 the dance hall burned down and the amusement park was closed forever. In 1928, the town of East Providence took over the water company and families that operated the company used the Hunt House. In 1936 the Hunt House became the offices for the East Providence Water Department until the mid-1980's when the water department moved to new offices. The city of East Providence owns the Hunts Mill area including the Hunt House and adjacent Caleb Williams House. Since 1989, the East Providence Historical Society has been restoring the house to its original appearance and operating it as a museum (East Providence Historic Properties Designation and Study Commission, 2002).

The river was dammed at Omega Pond during the early 20th century to create an industrial water supply. Conversely, Turner Reservoir was created as a drinking water supply for the city of East Providence. The dam at this site dates from about 1930. Turner Reservoir is no longer used as a back-up water supply for East Providence.

A Phase I archaeological survey of an Algonquian Gas Transmission Company 1.6 mile, 24-inch pipeline loop in Seekonk, MA and East Providence, RI was conducted in 1990 by the Public Archaeology Laboratory, Inc. This survey was conducted on the eastern side of Ten Mile River near the state border and running east into Seekonk along the Runnins River. During a walkover of the Rhode Island section of the pipeline route, it was determined that the section was located within a disturbed context and that no further testing was recommended. In a letter dated December 5, 1989, the Rhode Island State Historic Preservation Officer (RI SHPO) concurred with this determination.

A known archaeological site (19-BR-72) is located on the east bank of the Ten Mile River opposite the East Providence Water Works in Seekonk, Massachusetts. No

further information is available concerning this site. No other archaeological resources are recorded for the vicinity of the project area near the Ten Mile River and including Omega Pond, Hunts Mill, and Turner Reservoir.

H. Cultural and Economic Resources

East Providence is located between Providence, the urban center of Rhode Island, and Seekonk, Massachusetts. Access is via Interstate I-190 as well as Rhode Island State Route 152, which crosses Turner Reservoir. The population as of April 1, 2000 was 48,688 people, ranking it fifth among Rhode Islands 39 cities and towns. Based on land area of 13.41 square miles, the population density was 3,632 persons per square mile at this time. The City also contains 3.21 square miles of water surface area. Industries providing employment in 2000 were educational, health and social services (21.1 percent), manufacturing (19.4 percent), and retail trade (11.7 percent). A significant number of people are also employed in the professional, scientific and technical areas, and the health care, administrative and retail service areas (http://www.city-data.com/city/East-Providence-Rhode-Island.html).

The Ten Mile River is a major feature of the City, initially flowing southerly along the eastern border of the City and then flowing westerly through the City to the Seekonk River. Along its course it provides significant recreational and cultural resources for the city. Turner Reservoir/Central Pond is used heavily for recreation, including non-powered boating, canoeing, recreational fishing, as well as for hiking and bird-watching. The area surrounding Hunts Mill Pond provides parkland for picnicking and passive recreation. Also, the Museum of East Providence History is located at the historic John Hunt House on the original property of Hunts Mill. Omega Pond is also used for recreational fishing and non-power boating, as well as passive recreation.

The city of East Providence contains numerous other cultural and historic attractions in addition to the recreational and cultural resources provided by the dams and their associated impoundments. The most well known of these is the Charles I.D. Looff Carousel, built in 1895, which has been designated a National Historic Landmark by the National Park Service. Public recreational facilities in East Providence include approximately 250 acres of local parks and playfields, of which 60 acres are state parkland. The city is also located across the Seekonk River from Providence. Other recreational areas in adjacent communities include Slater Memorial Park in Pawtucket, Rhode Island and the Ten Mile River Reservation in Seekonk, Massachusetts. Slater Memorial Park contains a zoo, and both areas contain extensive forest and park areas, and wetlands adjacent to the Ten Mile River.

Resources at or near the footprints of the proposed fishways at each of the three dams include fishing and passive recreational activities such as bird watching, hiking, walking and picnicking. Access to the spillway area at Turner Dam is restricted due to safety concerns associated with the height of the abutment walls and spillway.

I. Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires federal agencies to examine proposed actions to determine whether they will have disproportionately high and adverse human health or environmental effects on minority or low income populations. The proposed project includes the construction of three fish ladders, at Turner Dam, Hunts Mill Dam and Omega Pond Dam. All three of these dams are located on property that belongs to the city of East Providence, are not in close proximity to minority or low income areas, and are not expected to have disproportionately high adverse effects on these populations.

J. Protection of Children

Executive Order 13045 "Protection of Children from Environmental Health Risks and Safety Risks" sees to protect children from disproportionately incurring environmental health risks or safety risks that might arise as a result of Army policies, programs, activities and standards. Environmental health risks and safety risks include risks to health and safety attributable to products or substances that a child is likely to come in contact with or ingest. None of the dams is located in close proximity to schools or playgrounds. The closest school is Seekonk High School, located within 2000 feet of Turner Reservoir Dam. Existing fences and other physical barriers control access to all three dams. However, as Hunts Mill Dam is adjacent to a City park, construction fencing will be required to make the site inaccessible to children.

K. Air Quality

Ambient air quality is protected by Federal and state regulations. The U.S. Environmental Protection Agency (EPA) has developed National Ambient Air Quality Standards (NAAQS) for certain air pollutants, with the NAAQS setting concentration limits that determine the attainment status for each criteria pollutant. The six criteria air pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

The entire State of Rhode Island, including Providence County, is designated as a non-attainment area for ozone. In April 2004, the EPA designated all five counties in Rhode Island as moderate non-attainment areas for the 8-hour ozone standard, including East Providence, Providence County where the project is located (U.S. Environmental Protection Agency, 2004b).

VII. Environmental Consequences

A. General

The proposed installation of fishways at Turner Reservoir Dam, Hunts Mill Dam, and Omega Pond Dam is not expected to have any significant long-term adverse effects on the existing environment of the Ten Mile River and the associated impoundments. Each fishway will provide fish passage for anadromous (and catadromous) fish to spawning habitat (and rearing habitat for eels) in sections of the Ten Mile River (including impoundments) upstream from each of the respective dams. The construction of fishways at these three dams is expected to have a positive effect on the overall ecosystem of the Ten Mile River as well as the city of East Providence. A major benefit of the restoration will be the contribution to estuarine and marine food webs from fish spawned in the Ten Mile River. The passage of anadromous fish at these dams will also provide an additional recreational opportunity where visitors will be able to observe the upstream migration of anadromous fish. Installation of interpretive signs would further explain the purpose and need for the fishways.

B. Terrestrial Environment

1. Topography

Construction of fishways at Omega Pond Dam, the Hunts Mill Dam, and Turner Reservoir Dam is not expected to have any significant effects on the topography in the vicinity of the projects. The projects will involve some alteration of the streambank at Hunts Mill Dam, as well as some excavation of the existing streambeds downstream from each of the dams. However, this will not significantly alter the overall bank and/or river configurations. Most of the grades of the existing banks will be untouched, and whatever changes are made will not have any significant adverse effects to the overall river morphology. The footprints of each of the fish ladders will be limited to a relatively small area of the streambed and spillway. The right stream bank at Hunts Mill Dam will also be modified to install the fishway. This will be an overall improvement to the area since an existing deteriorated water line will be removed as part of the project.

2. Geology and Soils

The construction of three fishways on the Ten Mile River at Omega Pond Dam, Hunts Mill Dam, and Turner Reservoir Dam is not expected to have any significant adverse effects on the existing geology of each of proposed sites. The fishway at Turner Reservoir will be notched into the existing concrete spillway, and run along a concrete headwall to the fishway entrance at the base of the spillway. The substrate of the area downstream from the concrete spillway consists of stone riprap. A small amount of this material may be excavated to create the proper discharge elevations and depths for the fishway entrance, but this will not significantly alter the overall configuration of the underlying bedrock bottom. The construction will be confined to mainly the river channel. In addition, no blasting of bedrock is proposed in the project area. The current design includes supporting the fishway with caissons imbedded into the bedrock.

Similarly, the proposed construction of a Denil fishway on the right bank of the river at Hunts Mill Dam is not expected to have any long term negative effects on the existing geology of the site. Construction will involve the excavation and removal of portions of the riverbank and man-made structures to install the fishway. No blasting of the existing bedrock in the area is anticipated.

At Omega Pond Dam, the fishway would be constructed by notching the spillway next to the left abutment. The concrete Denil fishway would descend along the spillway and railroad bridge abutment to the entrance channel at the foot of the spillway. The entrance channel is in a tidewater area consisting of a gravel and sandy bottom. This will be excavated in order to obtain the necessary entrance channel depths. The fishway will be supported on caissons placed into the underlying sand and silt. However, the amount of excavation will be minimal, and any changes to the underlying bank for the purpose of fishway construction are not expected to significantly alter the existing streambed configuration.

3. Vegetation

The proposed construction of three fishways on the Ten Mile River at Turner Reservoir Dam, Hunts Mill Dam and Omega Pond Dam is not expected to have any long-term negative effect on the existing vegetation in the vicinity of each of the three project areas. Most of the actual footprints of the projects consist of the concrete spillways of the dams, concrete headwalls, and rocky streambed, where there is minimal aquatic as well as upland bank vegetation. This is particularly the case for Turner Dam, where the proposed fish ladder will be constructed along the left side of the spillway and run along a concrete headwall to its discharge location in un-vegetated rocky streambed.

At Hunts Mill Dam the left side of the concrete spillway would be notched, and the proposed fish ladder will run along a concrete headwall to its discharge below the dam on bedrock. The vegetated stream bank will be excavated to construct the footings and fishway. Upon completion of the project, the streambank will be stabilized and replanted with native vegetation. Access will be through a previously disturbed upland area.

The construction of the fishway at Omega Pond Dam is also not expected to significantly effect upland and/or wetland vegetation. The existing dam and spillway at Omega Pond consists of concrete and granite block onto which the fish ladder will be constructed. The proposed footprint is within the area of the dam, with approximately 70 feet extending into the tidewater. This is not expected to have any significant impacts on the minimal vegetation present in that location.

In addition, since the pool levels in the impoundments will be maintained, wetlands supported by the existing water levels would not be impacted.

4. Wildlife

The proposed project is not expected to have any long-term negative impacts upon the existing wildlife in the vicinities of Turner Reservoir Dam, Hunts Mill Dam, and Omega Pond Dam. A long-term positive effect on the general wildlife population is expected within the riparian areas of the Ten Mile River in East Providence as anadromous fish return. Both the upstream migration of pre-spawning adult alewives and shad, as well as the downstream migration of juveniles, will provide beneficial forage to resident wildlife species, to include birds, as well as other predatory terrestrial wildlife. The construction of a fishway at each dam will have minimal impact on any of the surrounding stream habitat. The fishways would be constructed primarily along existing concrete headwalls and spillways, and other disturbed areas impacted by the existing dams. Construction access will be via existing roadways to the immediate vicinities of the dams, and then via temporary ramps constructed in the streambanks adjacent to these areas. Most terrestrial wildlife species that inhabit the immediate project areas are expected to temporarily relocate during construction. Conditions in the immediate footprint of the proposed fishway construction consist of: at Turner Reservoir, concrete headwalls and stone bottomed streambed; at Hunts Mill Pond, bedrock outcrop and concrete headwalls with gravel bottomed streambed; and at Omega Pond, granite block headwall and spillway, with sandy bottomed substrate as the stream flows into tidewater.

These predominately concrete structures and previously disturbed streambed areas are unlikely to provide suitable habitat for many resident wildlife species, and it is therefore unlikely that the project will have any long-term negative effects on resident wildlife. Any impacts that may occur will be temporary, and of short duration, lasting only until the project is completed.

5. Reptiles and Amphibians

The proposed construction of fish ladders on Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam is not expected to have any long term negative effects on the existing populations of amphibian and reptiles in the project area. This includes the upstream reaches of the Ten Mile River that will become accessible to up-migrating anadromous fish. As noted, the actual footprint of construction areas are in previously disturbed areas of rocky streambed and along existing concrete structures and headwalls in all of the dams. These areas have minimal aquatic habitat value for these species, and therefore it is unlikely that representatives of these species will be present in the actual footprint of the construction area.

C. Aquatic Environment

1. Hydrology

The construction of a fish ladder at each of the three dams, Turner Reservoir, Hunts Mill Dam and Omega Pond Dam, is not expected to have any significant long-

term negative effect on the overall hydrology of the Ten Mile River in these locations. The fishways will notch into the existing spillways of the dams, and will not alter the existing pool levels. The operation of these facilities will involve opening a stoplog control to allow water to flow during times of upstream and/or downstream anadromous fish migration and diverting a portion of the existing flow over the dam through the fishway. Attraction flow will be established at the entrance to the fishway, which will concentrate a portion of the flow on the side of the fish ladder at each of the dams. During non-migration periods the control at the exit pools will be closed allowing the water to flow over the existing spillways of these dams. Normal river flows at the discharge areas will be maintained. These small localized changes in the existing discharge characteristics of the stream are not expected to negatively effect the ecology of the river.

During construction, temporary portable dams or cofferdams will be constructed to de-water the construction area. This will enable the work to be done in the dry, and will minimize potential impacts to water quality resulting from construction activities. Following completion, these temporary structures will be removed and flows restored to that part of the riverbed.

2. Water Quality

The proposed project is not expected to have any long-term negative effects on the water quality of the Ten Mile River in the vicinity of and downstream from the three dams. Fish ladder construction will involve the temporary construction of a cofferdam at each construction location in order to conduct the work in the dry, and minimize any potential negative effects to water quality. Therefore the actual construction is expected to have minimal effects on the water quality of the Ten Mile River in the vicinity of the proposed project since the construction footprint will be contained. Any areas of the bank that have been disturbed due to the construction activities will be restored and stabilized. It is also anticipated that there will be no long-term negative effects to water quality from the proposed project since, once completed, the construction area will be restored and stabilized.

The resulting flow configuration of the fish ladders may actually improve water quality in the immediate vicinity of the fish ladders and downstream by providing additional aeration as the water flows through the baffles of the Denil fishway and the associated attraction flow pipe.

Construction of the fish ladders at Omega Pond and Turner Reservoir will involve creating a notch about two feet deep in the spillways to construct the exit channel of the ladder. As noted previously, the sediments behind each of the dams have been found to contain elevated levels of some contaminants, including some metals. This notching is not expected to disturb the sediments behind the dam, since it will involve only the top 2-3 feet of the water column. During construction, erosion control measures (e.g. silt curtains, cofferdams) will be employed to prevent and minimize the potential negative effects (elevated turbidities) resulting from silt or other sediment entering the river.

3. Riverine Processes and Sediment Chemistry

The proposed construction of fish ladders at the three dams on the Ten Mile River will not involve significant disturbance of the existing sediments either downstream or upstream from the construction area, therefore, it is not anticipated that the project will cause any significant sediment releases into the Ten Mile River. The dams will remain in place during construction and therefore any sediment behind them is not expected to be disturbed. During installation of the cofferdams on the impoundment side of the dams, small amounts of bottom sediment may be stirred into the water column. However it is expected that these will not cause any significant release of contaminants to the water column as the area impacted is small. It should be noted that during naturally occurring high flow events, bottom sediments from behind these dams can also be stirred up and enter the water column. As downstream cofferdams will be placed in areas of scoured bedrock or stone and gravel that contain minimal sediment, mobilization of sediment will also be minimal. In addition, the completed fish ladders will be discharging water onto scoured bedrock or stone lined stream bottoms without sediments, and will not mobilize any contaminated sediments.

Construction of fishways is not anticipated to significantly affect the anadromous fish moving through the Ten Mile River. Since most of the work will be conducted outside of the active anadromous fish migration season, it is unlikely they will be exposed to any suspended sediments with elevated concentrations of contaminants resulting from the construction activities. As part of the 1999 Turner Reservoir study noted earlier, fish tissue analysis was conducted on composite tissue samples from three samples each of largemouth bass, yellow bullhead, and white sucker (from Turner Reservoir and Central Pond). Results generally indicated the presence of some contaminants above EPA health risk levels for certain segments of the population. These are methyl mercury in largemouth bass, PCB's in white sucker, and PAH's in yellow bullhead.

These fish species are year round residents in Turner Reservoir. All three of these species are either top predators (largemouth bass) or bottom feeders (white sucker and yellow bullhead) and bioaccumulation can occur either by concentration up the food chain, or by direct ingestion from either the contaminated sediments themselves, or consumption of benthic organisms in close association with them. The anadromous river herring and shad, which are expected to return to the Ten Mile River, are predominantly plankton feeders (feeding from the water column) and therefore less likely to directly ingest contaminants, or bioaccumulate them since they are feeding lower in the food web. In addition, they are only temporary residents to the reservoir further reducing their exposure to potential contaminants. Therefore, although there may be the potential for these fish to be exposed to contaminants, they will be less than what the existing fisheries are normally exposed to. Therefore, the proposed construction activities and potential suspension of contaminated sediments are not expected to have any significant biological effects to the anadromous and resident fish species in Turner Reservoir or other ponds in the system.

D. Biological Resources

1. Aquatic Vegetation/Wetlands

The construction of fish ladders at the Turners Reservoir Dam, Hunts Mill Pond Dam, and Omega Pond dam is not expected to have any long-term negative effects on the aquatic and/or wetland vegetation in the vicinity of the project footprint(s). The fish ladders are proposed to run approximately 100 – 200 linear feet along the existing wing walls of each of the dams, with minimal disturbance to the bank areas. Those areas of the banks that may be affected at each of the dams have already been disturbed, and consist primarily of: 1) at Omega Pond, granite blocks forming the dam abutment and wing wall, 2) at Hunt's Mill Pond, an area of upland adjacent to a combination of boulder/bedrock stream bed and the remains of a former penstock and steel conduit with stone supports; and 3) at Turner's Reservoir, a long concrete wing-wall which extends along the existing streambed composed of boulders and bedrock. In all of these locations, minimal aquatic vegetation exists, and the existing substrates of boulder/cobble and/or concrete from the various headwalls and wing walls of the dam abutments primarily determine the actual habitat. The water levels at the impoundments behind each of the dams will be maintained at their existing elevations, which will maintain the existing wetlands behind them (specifically those at Turner Reservoir). Cofferdams are not expected to significantly alter water surface elevations upstream of the dams. At Turner Reservoir Dam, operating the gates could mitigate any potential increases.

2. Fisheries

The proposed project is expected to have an overall positive effect upon the fisheries of the Ten Mile River. The construction of a fish ladder will allow the upstream passage of anadromous (and catadromous) fish to their historic habitat upstream from the Omega Dam, the Hunts Mill Dan and the Turners Reservoir Dam, in the lower portion of the Ten Mile River watershed, opening up an approximate 6-mile anadromous fish migratory corridor. In addition, the existing spawning and nursery habitat within Omega Pond, Hunts Mill Pond, and Turner Reservoir (i.e. the impoundments behind each of the dams) will become accessible to anadromous alewife, blueback herring and American eel. This will benefit the existing fishery as well as the ecosystem by not only restoring historic species, but by the influx of additional forage for the existing fish populations. Generally, in freshwater areas where river herring (i.e. alewives and blueback herring) have been restored, studies show that resident fish populations have been enhanced. The juvenile herring produced in the spawning run serve as food supply for bass and other resident and/or migratory species. All life stages of anadromous herrings are important forage for many freshwater and the marine fishes (e.g. striped bass) that occur in the estuary.

Fisheries impacts resulting from construction activities are discussed in the previous section on Riverine Process and Sediment Chemistry. As stated in that section, potential suspension of contaminated sediments during construction is not expected to

have any significant biological effects to resident and anadromous fish species along the lower Ten Mile River.

As noted, earlier, fisheries sampling conducted at Turner Reservoir during the summer of 1999 collected relatively few forage species such as golden shiner and white sucker, particularly in the South Pond at Turner Reservoir. The re-introduction of these species into Turner Reservoir as well as the other impoundments behind Hunts Mill and Omega Pond would provide additional forage for the existing predator game fish population (i.e. largemouth bass, black crappie, chain pickerel) benefiting the populations of these species.

If anadromous alewives, blueback herring, and shad are restored to the ecosystem (i.e. by providing a fishway), then it is expected that the eels, as well as other predator species (e.g. largemouth bass, black crappie) would benefit by the increased forage base provided by the various life stages of these fish. In addition, the fishways would facilitate easier migration for the existing eels, as well as many potamodromous (riverine species that migrate upstream to spawn) fish living in the Ten Mile River and its impoundments.

E. Threatened and Endangered Species

Coordination with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Rhode Island Department of Environmental Management has indicated that no Federally-listed threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service and National Marine Fisheries Service occur in the vicinity of the proposed project on the downstream section of the Ten Mile River, with the exception of occasional transient bald eagles (*Haliaeetus leucocephalus)* (See letters dated April 23, 2003 and April 1, 2003). The proposed construction footprint for the fish ladders at each of the three dams will primarily be in areas which have been previously disturbed consisting of concrete wing walls, head walls, and boulders, with minimal aquatic habitat. Therefore it is anticipated that there will not be any negative effects to any federally listed threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service or National Marine Fisheries Service in the vicinity of the proposed project.

F. Assessment of Essential Fish Habitat

The proposed construction of three fishways on the Ten Mile River at Omega Dam, Hunts Mill Dam and Turner Reservoir Dam, is not expected to have long-term adverse effects on Essential Fish Habitat. Sections of Narragansett Bay (Providence and Seekonk Rivers) that receive flow from the Ten Mile River have been designated Essential Fish Habitat by NMFS for the adult and juvenile life stages of Winter flounder, Summer flounder, Windowpane flounder, Bluefish, Scup, Atlantic mackerel, Black seabass, King mackerel, and Spanish mackerel. The construction of these fish ladders

will be done upstream from the tidal areas, in freshwater, with erosion control measures employed to maintain water quality. Therefore no significant short and/or long-term negative effects to the water quality of the Ten Mile River downstream from the Omega Pond Dam is expected that could negatively affect Essential Fish Habitat for the species noted above. Although there may be some temporary increases in turbidity, these are not expected to be significant due to the erosion control measures that will be employed. Releases of significant amounts of potentially contaminated sediments from behind the dams are not expected to occur, due to the dams' remaining in place, as well as the use of cofferdams and/or other diversion methods to allow work to be done in the dry.

The anadromous river herring as well as shad can serve as prey (forage) for the managed species noted above. The proposed fishways are expected to restore historic anadromous fish spawning runs to the Ten Mile River which will increase the numbers of anadromous river herring and shad in the marine environment providing additional forage for the managed marine/estuarine species noted. Therefore, the proposed project is expected to have an overall positive effect on the EFH for the listed species inhabiting the estuarine areas of the Seekonk and Providence Rivers, as well as those in Narragansett Bay.

G. Historical and Archaeological Resources

, Construction of a fish ladder at Omega Pond Dam will have no adverse effect upon historical or archaeological resources. Although the structure is considered eligible for listing on the National Register of Historic Places, the RI SHPO, by letter dated May 17,2003 (see Appendix A), concurred that there would be no adverse effect on the dam. The ladder would be designed to accommodate the existing impoundment and minimize the visual impacts.

The proposed fishway installation at Turner Reservoir Dam will have no effect on historic resources. By letter dated May 27, 2003 (see Appendix A), the RI SHPO concurred with this determination, and stated that the dam is not considered eligible for listing on the National Register of Historic Places.

Construction of a fish ladder at the Hunts Mill Dam, however, will constitute an adverse effect upon what is a significant contributing element to a National Register Historic District, the Rumford Historic District. This adverse effect constitutes "an undertaking that may alter directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR 800.5(a)(1)). Construction of a fish ladder at this location constitutes the "introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features" (36 CFR 800.5(a)(2)).

In accordance with 36 CFR 800.6(a) of the Advisory Council on Historic Preservation's (ACHP) regulations, further consultation is required with the RI State Historic Preservation Officer (SHPO) and any other consulting parties "to develop and evaluate alternatives or modifications to the undertaking that could avoid, minimize, or mitigate adverse effects on historic properties." Proper design of the fishway in this location and its incorporation within the existing sluiceway will constitute partial mitigation of this impact.

Historical documentation of the existing Hunts Mill Dam and background research to determine the archaeological sensitivity of the surrounding area of the dam have been discussed with Mr. Richard Greenwood of the RI SHPO as additional potential mitigation measures. An intensive level archaeological investigation of the riverbank area that would be disturbed for the fishway structure is proposed prior to construction. Further consultation during the Plans and Specifications phase of the project will lead to the preparation of a Memorandum of Agreement (MOA) between the Corps, the RI SHPO, the East Providence Historic Properties Commission, other interested parties, and potentially, the ACHP, regarding mitigation at the Hunts Mill Dam and vicinity. Adherence to the stipulations in the MOA will signify compliance with the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR 800.

H. Cultural and Economic Resources

The proposed construction of fish passage facilities at the Omega Dam, Hunts Mill Dam and Turner Reservoir Dam is expected to have a positive effect on the cultural and economic resources of the city of East Providence and vicinity. As noted previously, the Ten Mile River itself provides a significant recreational resource, with the impoundments behind each of the three dams used for fishing, non-power boating (at Turners Reservoir and Omega Pond), as well as other passive/non passive recreational activities (hiking, bird watching, picnicking). Fish ladders can provide an additional recreational opportunity of viewing the migrating fish and would be a recreational asset to the City. Hunts Mill Dam is one area in particular where this could occur since the dam is currently in a small park used for picnicking and hiking. In addition, the ecological benefits of anadromous fish restoration are expected to enhance the existing fisheries on the Lower Ten Mile River, potentially attracting recreational fishers to these areas, specifically to Turners Reservoir and Omega Pond.

I. Environmental Justice

The proposed project is not expected to pose impacts upon any minority or low-income populations adjacent to or in the vicinity of the project pursuant to Executive Order No. 12898. This will benefit the ecosystem and have a positive effect upon the fisheries. It will also provide benefits to the recreational fisher community in general, including any low-income fishers that may be using the river for subsistence fishing.

Access will be, for Turner Reservoir; through suburban residential roadways to City owned land, which is abutted by residential property with private dwellings. For Hunts Mill Dam access will be through residential roadways and a City park access road, with the actual construction being on City owned property. At Omega Pond access will be via residential suburban roadways leading to private industrial property abutting the City and State owned property at the location of the dam. Although low income and/or Environmental Justice populations are present in the city of East Providence as well as Providence, they are not likely to be disproportionately adversely affected by the construction of fishways along the three dams noted. The impoundments behind the dams will remain intact, allowing the existing recreational fisheries to continue, which may include use by subsistence fishers who depend upon fishing for supplemental food supply

J. Protection of Children

EO 13045 requires federal agencies to examine proposed actions to determine whether they will have disproportionately high human health or safety risks on children. During the construction phase of the proposed project, heavy construction equipment and vehicles will be transported to the site. However, the actual site will be fenced off to prevent unauthorized personnel from entering the work area (including children). In addition there will be a temporary increase in truck traffic transporting materials to and from the site. These trucks will be limited to the public roadways, and the existing project access roads (rights of way), and are therefore not expected to cause any disproportionate direct, indirect or cumulative impact to children associated with environmental health or safety risks. Although the increase in truck traffic itself may create a temporary safety hazard, it will be for a short duration. Construction at each dam is expected to take approximately three months. Therefore, this increased traffic will be for a short duration and temporary. There are no schools located in close proximity to the three construction areas. Seekonk High School is the closest, being within 2000 feet of Turner Reservoir Dam.

There will not be any alteration of the existing safety fences, which limit access to the potential fall areas of the dams. Currently fences are in place on the dam abutments at Turner Dam, as well as at Hunts Mill Dam. These will remain in place during and after construction activities. In addition, areas of the fishways where there may be potential safety hazards will be grated and/or fenced to prevent direct access by children. Control of access during construction will be particularly important at Hunts Mill Dam due to the adjacent park/recreation area. Omega Pond Dam, although not fenced off, is located in an industrial area generally not used by children unless accompanied by adults. General precautions of locking out equipment when not in use will be employed during construction.

K. Air Quality Statement of Conformity

1. Statement of Conformity Requirements

U.S. Army Corps of Engineers guidance on air quality compliance is summarized in Appendix C of the Corps Planning Guidance Notebook (ER1105-2-100, Appendix C, Section C-7, pg. C-47). Section 176 (c) of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformance with Federally-approved CAA State Implementation Plans (SIP) for geographic areas designated as non-attainment and maintenance areas under the CAA. The EPA General Conformity Rule to implement Section 176 (c) is found at 40 CFR Part 93.

Clean Air Act compliance, specifically with EPA's General Conformity Rule, requires that all Federal agencies, including Department of the Army, to review new actions and decide whether the actions would worsen an existing National Ambient Air Quality Standards (NAAQS) violation, cause a new NAAQS violation, delay the SIP attainment schedule of the NAAQS, or otherwise contradict the State's SIP.

The State of Rhode Island is authorized by the EPA to administer its own air emissions permit program, which is shaped by its State Implementation Plan (SIP). The SIP sets the basic strategies for implementation, maintenance, and enforcement of the NAAQS. The SIP is the federally enforceable plan that identifies how that state will attain and/or maintain the primary and secondary NAAQS established by the EPA (U.S. Environmental Protection Agency, 2004b). In Rhode Island, Federal actions must conform to the Rhode Island state implementation plan or Federal implementation plan. The Corps must evaluate and determine if the proposed action (construction and operation) will generate air pollution emissions that aggravate a non-attainment problem or jeopardize the maintenance status of the area for ozone. When the total direct and indirect emissions caused by the operation of the Federal action/facility are less than threshold levels established in the rule (40 C.F.R. § 93.153), a Record of Non-applicability (RONA) is prepared and signed by the facility environmental coordinator.

2. Construction and Operation

Construction would occur over a period of about 6 to 9 months. Construction activity at the proposed project site would require bulldozers, dump trucks, pick-up trucks, cranes, forklifts, front-end loaders, and other construction equipment, including small generators and pumps.

During construction, equipment operating at Omega Pond, Hunt's Mill Pond, and Turner Reservoir would emit pollutants including nitrogen oxides that can lead to the formation of ozone. The construction of three fish ladders (one at each pond) would involve vehicles transporting cement (cement mixers) and other construction equipment to and from the site. These vehicles will be in compliance with the state's vehicle emission program

Equipment operating on the construction site (non-road construction equipment) will emit pollutants that contribute to increased levels of criteria pollutants such as carbon monoxide, nitrogen oxides, and ozone. The emissions for construction vehicles and related equipment will have an insignificant impact to local air quality.

Construction of the proposed project could cause a temporary reduction in local ambient air quality because of fugitive dust and emissions generated by construction equipment. The extent of dust generated would depend on the level of construction activity and dryness. Proper dust suppression techniques would be employed to avoid creating a nuisance for nearby residents during dry and windy weather.

In order to minimize air quality effects during construction, all construction operations would comply with applicable provisions of the State of Rhode Islands air quality control regulations pertaining to dust, odors, construction, noise, and motor vehicle emissions. No direct or indirect increases or other changes in local or regional air quality are likely to occur with the construction and operation of the proposed project.

3. General Conformity

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions "conform with" (i.e., do not undermine) the approved SIP for their geographic area. Federal agencies make this demonstration by performing a conformity review. The conformity review is the process used to evaluate and document project-related air pollutant emissions, local air quality impacts and the potential need for emission mitigation (Polyak, K and Webber, L. 2002). A conformity review must be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more NAAQS. Non-attainment areas are geographic regions where the air quality fails to meet the NAAQS.

The project is located in Providence County, East Providence, Rhode Island. East Providence is considered to be non-attainment for ozone, receiving a “moderate” classification under the new 8-hour ozone air quality classification. The General Conformity thresholds for ozone in a moderate non-attainment area have an emission rate threshold of 50 tons per year (tons/year) of VOC (volatile organic compounds) and100 tons/year of NO_x (nitrogen oxides) (U.S. Army Environmental Center, 2002) (40 CFR 51.853, 7-1-03).

To conduct a general conformity review and emission inventory for the proposed construction of the three fish ladders, a list of construction equipment was identified using the project construction cost estimate. The first column of the emissions calculations table provides a summary equipment list. The New England District prepared calculations of the worst-case project specific emissions of NOx and VOCs to determine whether project emissions would be under the General Conformity Trigger Levels. Because of the small scale of the project, several simplifying assumptions were

applied in performing the calculations to prepare a worst-case analysis. The actual emissions would most likely be much lower, but in no case above the calculated values. For instance, the load factor is the average percentage of rated horsepower used during a source's operational profile. To simplify the calculations, we used a worst-case estimate of 1.0, or 100 percent, for all equipment. We used 10 hours per day as worst-case hours of operation for most equipment, except pumps for which we used 24 hours per day of operation. We used the total construction duration minus non-work days (i.e. holidays, weekends, and weather days) to estimate days of operation, rather the specific days of operation for each piece of equipment. Based on these calculations, the worst-case NOx emissions were 91.14 tons and the worst-case VOC emissions were 13.01 tons. In both cases, the total construction emissions were below the General Conformity Trigger Levels. These calculations are presented in the Record of Non Applicability for Clean Air Act Conformity (RONA) at the end of this Environmental Assessment.

Detailed calculations (i.e. not worst case) for several projects of similar scale in the Corps of Engineers, Philadelphia District (small navigation, emergency streambank stabilization, and ecosystem restoration projects in New Jersey, and a road maintenance project in Delaware) had calculated emissions well below the 100 tons per year threshold. Table 6.8-1 summarizes the emissions estimates for these 4 projects. Detailed calculations for the Ten Mile River fish ladder project would be likely to have values closer to this range. The RONA contains the equipment list for the Ten Mile River project, and the calculations and listing of equipment for it and the 4 projects in the Philadelphia District.

Table 6.8-1
Estimated Project Emissions for Ozone at 4 Corps of Engineers Projects Located in Severe Non-Attainment Areas

Project	Location	Type	Maximum Pollutant (tons) NOx	VOCs
Wills Hole Thorofare	New Jersey	Small Navigation-Dredging	9.80	0.25
Barnegat Bay Dredged Hole #6	New Jersey	Ecosystem Restoration	19.90	0.36
Manasquan River at Bergerville Rd	New Jersey	Streambank Stabilization	0.69	0.10
Summit Bridge Road Maintenance	Delaware	Road Maintenance	5.01	0.71
		Combined totals:	35.40	1.42
		Multiple of 2 combined totals (tons):	70.80	2.84

The total estimated direct and indirect emissions that would result from construction of three fish ladders on the Ten Mile River are below the General Conformity trigger levels of 100 tons per year of NOx and 50 tons per year of VOCs. General Conformity under the Clean Air Act, Section 176 has been evaluated for the project according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project because the total direct and indirect emissions from the project are below the conformity threshold values established at 40 CFR 93.153 (b) for ozone (NOx and VOCs) in a moderate attainment area.

The determination of whether or not a project is regionally significant is if its emissions exceed 10% of the state's total emissions budget for the criteria pollutants (40 CFR 93.153 (i)). Appendix A of the Rhode Attainment Plan for the One-Hour Ozone National Ambient Air Quality Standard (RIDEM, March 2003) lists the total emissions inventories for each source in the state for various years, and predicts estimated inventories for 2007. These inventories are calculated as tons per summer day (tpsd) and show that for mobile sources alone, values of 30.68 tpsd of VOCs and 33.97 tpsd of NOx are predicted for 2007. As noted, the emissions for the Ten Mile River fish ladder project are estimated to be 91.14 and 13.01 tons *per year* for both VOCs and NOx respectively. These values show that in approximately three days, mobile sources alone within the entire state of Rhode Island would exceed the *yearly* estimated emissions for both VOCs and NOx for the proposed Ten Mile River fish ladder project. Therefore the estimated emissions for the proposed project are below 10% of the total emissions inventory for the State of Rhode Island. The Army activity does not reach the threshold levels established by the EPA rule, and is not regionally significant, and therefore the conformity rule is inapplicable here.

VIII. Cumulative Impacts

The proposed construction of fishways at Omega Pond Dam, Hunts Mill Dam, and Turner Reservoir Dam is not expected to have any significant adverse cumulative impacts to the biological resources in the vicinity. The work will be conducted during the low flow season in order to minimize effects to existing fisheries, and will not have any significant adverse effects on wetlands or aquatic habitat due to the footprint(s) being located in previously disturbed areas. The project will have a beneficial effect on the fisheries, restoring anadromous fish to their historic spawning areas. In addition, the influx of anadromous fish to the ecosystem is expected to provide additional forage for existing predator species in Omega Pond, Hunts Mill Pond and Turner Reservoir, having a positive effect in the overall productivity. These anadromous fish will also provide forage for various marine and estuarine predator species (e.g. striped bass, bluefish) in the marine environment. This will provide a long-term beneficial effect on both the marine and freshwater ecosystems that these anadromous fish utilize for their habitat. Together with other anadromous fish restoration projects throughout the watershed and other coastal areas of the Northeast, anadromous fish populations will experience substantial increases in population numbers contributing to restoration of important marine, estuarine, and freshwater fish stocks. Further construction activities at the dams (which could cumulatively affect the ecosystem) are not anticipated for several years, which should provide sufficient time for any ecosystem components affected by the fishway construction to recover. No significant releases of sediments from behind the dams are expected to occur from the construction activities.

IX. Actions Taken to Minimize Impacts

Construction of a fishway at Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam is proposed to occur during the low flow season outside of the times of any existing anadromous fisheries downstream migration. A Clean Water Act, Section 401 Water Quality Certificate as well as any other permits will be obtained prior to construction activities. During construction, flows will be diverted around the construction site, and proper erosion control measures will be utilized. This will minimize any potential water quality impacts to the river from silt runoff. It is anticipated that downstream flows will not be altered either during or after construction. Construction at Hunts Mill Dam will be conducted in coordination with the State of Rhode Island Historical Preservation Office in order to minimize potential negative effects to the historic Hunts Mill Dam. Cofferdams and/or other temporary diversion or containment structures will be employed prior notching the spillways in order to prevent release of sediment to the water column from behind the dams.

X. Coordination

A. Personal Communication

The Corps of Engineers coordinated with the following persons in the preparation of this report.

Mr. John O'Brien,
State of Rhode Island Department of Environmental Management
Division of Fish and Wildlife

Ms. Wenley Ferguson
Save the Bay, Inc.
Providence, Rhode Island

Mr. Tom Ardito
State of Rhode Island Department of Environmental Management
Narragansett Bay Estuary Program

Mr. Richard Greenwood
State of Rhode Island
Historical Preservation and Heritage Commission

Mr. Richard Quinn
U.S. Fish and Wildlife Service
Engineering Field Office
Newton Corner, MA

Ms. Jeanne M. Boyle
Planning Director
City of East Providence

Mr. David Kelleher
Historical Properties Commission
City of East Providence

Mr. Patrick Hanner
Planning Office
City of East Providence

Mr. Allen Libbey
State of Rhode Island Department of Environmental Management
Division of Fish and Wildlife

B. Site Visit

Corps of Engineers personnel held a coordinated site visit in July 2001. The following people attended:

Mr. John O'Brien,
State of Rhode Island Department of Environmental Management
Division of Fish and Wildlife

Ms. Wenley Ferguson
Save the Bay, Inc.

Mr. Richard Quinn
U.S. Fish and Wildlife Service

Mr. Richard Heidebrecht
U.S. Army Corps of Engineers
New England District

Mr. Kenneth Levitt
U.S. Army Corps of Engineers
New England District

C. Correspondence

1. Coordination Letters

Project coordination letters were mailed to the following people prior to the preparation of this report pursuant to the Fish and Wildlife Coordination Act, Endangered Species Act, and the National Historic Preservation Act and NEPA:

Mr. Michael Bartlett
U.S. Fish and Wildlife Service
70 Commercial Street
Suite 300
Concord, NH 03301-5087

Mr. Jack Terrill
Asst. Regional Admin. for Habitat Conservation
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

Mr. Michael Ludwig
National Marine Fisheries Service
Milford Laboratory
212 Rogers Street
Milford, CT 06460

Mr. Greg Mannesto
U.S. Fish and Wildlife Service
Rhode Island Field Office
Route 1A, Shoreline Plaza, P.O. Box 307
Charlestown, RI 02908

Mr. Peter Holmes
U.S. Environmental Protection Agency
One Congress Street, Suite 1100 (CRI)
Boston, MA 02114-2023

Ms. Terry Walsh
Rhode Island Department of Environmental Management
Bureau of Environmental Protection
Water Resources
235 Promenade Street
Providence, RI 02908

Mr. Jan Reitsma, Director
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02903

Mr. Edward F. Sanderson, Executive Director
Deputy State Historic Preservation Officer
Historical Preservation and Heritage Commission
State of Rhode Island and Providence Plantations
Old State House
150 Benefit Street
Providence, RI 02903-1209

Mr. Alan M. Corvi, P.E.
City Engineer
City of East Providence
145 Taunton Avenue
East Providence, RI 02914-4505

Ms. Alicia Good, PE
Assistant Director of Water Resources
Bureau of Environmental Protection
Rhode Island Department of Environmental Resources
235 Promenade Street
Providence, RI 02914-4505

Mr. Stephen H. Coutu, P.E.
DPW Director
City of East Providence
145 Taunton Avenue
East Providence, RI 02914-4505

Mr. Curt Spalding
Executive Director
Save the Bay, Inc.
434 Smith Street
Providence, RI 02914-4505

Mr. John O'Brien
State of Rhode Island Department of Environmental Management
Division of Fish and Wildlife
4808 Tower Hill Road
Wakefield, RI 02879

Mr. Malcolm J. Grant
Associate Director
Bureau of Natural Resources
235 Promenade Street
Providence, RI 02908-5767

Mr. Thomas A. Dupree, Chief
Division of Forest Environment
Rhode Island Department of Environmental Management
Bureau of Natural Resource
1037 Hartford Pike
North Situate, RI 02857

Mr. Peter Colosi
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

Mr. Robert W. Varney, Regional Administrator
United States Environmental Protection Agency
Region I, New England
One Congress Street, Suite 1100
Boston, MA 02114-2023

2. Public Notice

A Public Notice describing the project was distributed on (date to be added in final EA).

A copy will be included as an attachment to the final Environmental Assessment.

3. Distribution of the Draft Report

A distribution list will be included in the final report.

4. Correspondence Received

Pertinent Correspondence will be included in Appendix A of the final report.

XI. References/Literature Cited

Blodgett, 1998. A Checklist of the Birds of Massachusetts. MassWildlife Field Headquarters, 1 Rabbit Hill Road, Westborough, MA 01581, (508) 792-7270, www.state.ma.us/dfwele/dfw

Carlander, Kenneth D. 1977. Handbook of Freshwater Fishery Biology, Volume Two. Iowa State University Press, Ames, Iowa.

Cordoza, James E.; Jones, Gwilym S., and Thomas W. French. MassWildlife's State Mammals List, 4th Addition. 1999. Massachusetts Division of Fisheries and Wildlife Web Page. http://www.state.ma.us/dfwele/dfw/dfwwld.htm
James E. Cardoza, Massachusetts Division of Fisheries & Wildlife
Gwilym S. Jones, Center for Vertebrate Studies, Dept. Biology, Northeastern University, Boston, MA. Thomas W. French, Massachusetts Division of Fisheries & Wildlife.

East Providence Historic Properties Designation and Study Commission 2002 Historic East Providence: An Illustrated Tour. East Providence Historic Properties Designation and Study Commission, David Kelleher, Chair

EPA, 2004. Website accessed 1/02/05. http://www.epa.gov/oar/oaqps/greenbk/gncs.html#RHODE%20ISLAND

Long, E.R. and L.G. Morgan, 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program, NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, Washington, March 1990; as cited in New England Division (NED) U.S. Army Corps of Engineers, August 1993. Hop Brook Lake, Connecticut Priority Pollutant Scan.

MA DEP. 1996. (Revision of 1995 Report). Massachusetts Surface Water Quality Standards. Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA (Revision of 314 CMR 4.00, effective June 23, 1996).

Massachusetts Executive Office of Environmental Affairs, Department of Environmental Protection, Office of Watershed Management. River Facts: Ten Mile River Watershed Brief, From The Ten Mile River Watershed Alliance, P.O. Box 823, Attleboro, MA 02703. (http://www.ci.attleboro.ma.us/tenmileriver/riverfacts.htm).

MassWildlife's State Reptiles & Amphibians List, (3rd ed., 2000, Revised 2002). James E. Cardoza and Peter B. Mirick. Massachusetts Division of Fisheries and Wildlife Fauna of Massachusetts Series No. 3.

Persaud, D.R. Jaagumagi, and A. Hayton. 1993. "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario." ISBN 0-7729-9248-7. Ontario Ministry of Environment and Energy. Queen's Printer for Ontario, 1993; as cited

in New England District (NAE) U.S. Army Corps of Engineers, January 1999. French River Projects Priority Pollutant Scan.

Polyak, K and Webber, L. 2002. Technical Guide for Compliance with the General Conformity Rule. U.S. Army Center for Health Promotion and Preventative Medicine, Directorate of Environmental Health Engineering, Air Quality Surveillance Program.

Rhode Island Air Toxics Guideline. 2004. Website accessed 1 February, 2005. <http://www.state.ri.us/dem/programs/benviron/air/pdf/airtoxgl.pdf>

Rhode Island Department of Environmental Protection. 2004. Office of Air Resources Overview. Website accessed 2 February, 2005. http://www.state.ri.us/dem/programs/benviron/air/index.htm

Rhode Island Economic Development Corporation, City of East Providence, Rhode Island RIEDC, One West Exchange Street, Providence, RI 02903
Phone (401) 222-2601; Fax (401) 222-2102, E-mail riedc@riedc.com.

Rhode Island Historical Preservation Commission
1980 National Register of Historic Places Inventory - Nomination Form, Rumford Historic District, East Providence, Rhode Island.

1976 East Providence, Rhode Island Statewide Preservation Report P-EP-1.

Save the Bay Website, Ten Mile River Anadromous Fish Run Restoration Project, http://www.savebay.org/bayissues/restoreprojects.htm#fishrun

Slater, Caleb, 2001. Job Performance Report, Massachusetts, Project Number F-45-R-19, Study 1-Connecticut River Anadromous Fish Investigations; Job 2W – Westfield Fish Passage. Massachusetts Division of Fisheries and Wildlife, Field Headquarters, 1 Rabbit Hill Road, Westborough, MA 01581

Ten Mile River Basin, 1997 Water Quality Assessment Report. Commonwealth of Massachusetts Executive Office of Environmental Affairs, Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management, Worcester, Massachusetts, March 2000.

Ten Mile River Watershed, Draft Five Year Watershed Action Plan, 2002-2006. June 1, 2001. EOEA Ten Mile River Watershed Team Action Planning Subcommittee.

Toward a Cleaner Ten Mile River. A Public Report – September 1985. Rumford River Laboratories, Foxboro, Massachusetts.

Turner Reservoir Study, East Providence Rhode Island. February 2001. U.S. Army Corps of Engineers, New England District, 69 Virginia Road, Concord, MA, 01742.

U.S. Geological Service, Water Resources of Massachusetts and Rhode Island, Major Drainage Basins of Massachusetts and Rhode Island, Ten Mile River Drainage Basin, October 11, 2001. URL: http://ma.water.usgs.gov/basins/tenmile.htm

.

XII. Compliance With Environmental Statutes and Executive Orders

Federal Statutes

1. Archaeological Resources Protection Act of 1979, as amended, 16 USC 470 et seq.

Compliance: Not Applicable – Not Federal land.

2. Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Project will be coordinated with the State Historic Preservation officer. Impacts to archaeological resources will be mitigated.

3. American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: Coordination with the RI SHPO and Wampanoag Tribe will continue during the Plans and Specs phase of the project.

4. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Public notice of the availability of this report to the Environmental Protection Agency is required for compliance pursuant to Sections 176c and 309 of the Clean Air Act. A Statement of Conformity is included in Section VIII. K of this Environmental Assessment.

5. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance review has been incorporated into the project report. An application shall be filed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.

6. Coastal Zone Management Act of 1982, as amended, 16 U.S.C. 1451 et seq.

Compliance: A CZM consistency determination shall be provided to the State for review and concurrence that the proposed project is consistent with the approved State CZM program.

7. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) has determined no formal consultation requirements are necessary pursuant to Section 7 of the Endangered Species Act.

8. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Not Applicable. Applicable only if report is being submitted to Congress.

9. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Public notice of availability of the project report to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the FWS, NMFS, and State fish and wildlife agencies signifies compliance with the Fish and Wildlife Coordination Act. A Final Coordination Act Report (FCAR) under Section 2 (b) has been incorporated into this Environmental Assessment.

11. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Public notice of the availability of this report to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

12. Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.

Compliance: Not applicable. The project does not involve the transportation or disposal of dredged material in ocean waters pursuant to Sections 102 and 103 of the Act, respectively.

13. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the State Historic Preservation Office signifies compliance.

14. Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170

Compliance: Regulations implementing NAGPRA will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of an Environmental Assessment signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is signed.

16. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for projects or programs authorized by Congress. The proposed aquatic ecosystem restoration project is being conducted pursuant to the Congressionally-approved authority.

17. Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: Floodplain impacts have been considered in project planning (see Appendix B, Flood Flows).

18. Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: No Impact. The Ten Mile River has not been designated as a Wild and Scenic River by the Department of the Interior.

19. Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.

Compliance: Coordination with the National Marine Fisheries Service and preparation of an Essential Fish Habitat (EFH) Assessment signifies compliance with the EFH provisions of the Magnuson-Stevens Act.

Executive Orders

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971.

Compliance: Coordination with the State Historic Preservation Officer signifies compliance.

2. Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

3. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Public notice of the availability of this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

4. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not applicable to projects located within the United States.

5. Executive Order 12898, Environmental Justice, 11 February 1994.

Compliance: The project is not expected to have a significant impact on minority or low income population, or any other population in the United States.

6. Executive 13007, Accommodation of Sacred Sites, 24 May 1996

Compliance: Not applicable. Project is not located on Federal land. If so, agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

7. Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April 1997.

Compliance: The project would not create a disproportionate environmental health or safety risk for children.

8. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with Executive Memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance. Copies of RI SHPO correspondence have been forwarded to the Wampanoag Tribe.

Executive Memorandum

Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not applicable. The project does not involve or impact agricultural lands.

White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: In compliance. Copies of RI SHPO correspondence have been forwarded to the Wampanoag Tribe.

Rhode Island Ecosystem Restoration Project
Ten Mile River Aquatic Habitat Restoration Study
Anadromous Fish Run Restoration
East Providence, Rhode Island

Finding of No Significant Impact

The proposed Federal action involves the construction of three Denil type fishways on the lower Ten Mile River in East Providence Rhode Island, to provide anadromous fish passage beyond Omega Pond Dam, Hunts Mill Dam, and Turner Reservoir Dam. This will allow upstream migration of anadromous fish to spawning and nursery habitat above each of the dams, as well as additional habitat in the Ten Mile River and its tributaries upstream from Turner Reservoir to the Golf Club Dam in Pawtucket, Rhode Island. In addition, upstream and downstream passage will be provided for catadromous fish (i.e. American eel) as well as resident river species that were previously unable to pass to areas upstream of the dams. In total, the fishways will provide access to approximately 340 acres of lacustrine and three river miles of riverine habitat for anadromous species such as American shad, blueback herring and alewife.

The fish ladder at Omega Pond Dam (which is located at the head of tide) will be constructed on the left bank of the river and will tie into the existing spillway and descend adjacent to the existing downstream abutment to tidewater. At Hunts Mill Dam, the fish ladder will be constructed on the right bank of the river, tying into the right side of the spillway and having its entrance channel along the downstream bank. At Turner Reservoir, the fish ladder would be constructed on the left downstream bank, tying into the spillway and running parallel to the downstream abutment. At all three dams, construction will be in previously disturbed streambed or riverbank areas located downstream from each of the dams. Minimal vegetated wetland habitat exists in the footprints of the proposed projects. No significant long term or short-term adverse impacts to the environment are anticipated. Construction will begin on or after August 2005 when river conditions permit minimum impact to migratory fish species.

Hunts Mill Dam is listed on the Register of National Historic Places. Coordination with the State of Rhode Island Historic Preservation Office is ongoing in order to ensure that the proposed project will avoid, minimize or mitigate potential adverse effects to this historical property. In addition, an intensive level archaeological investigation of the riverbank area that would be disturbed for the fishway structure is proposed prior to construction. Further consultation during the Plans and Specifications phase of the project will lead to the preparation of a Memorandum of Agreement (MOA) between the Corps, the RI State Historic Preservation Officer (SHPO), the East Providence Historic Properties Commission, other interested parties, and potentially, the Advisory Council on Historic Preservation.

My determination of a Finding of No Significant Impact is based on the Environmental Assessment and the following considerations:

a. The project will restore a historic anadromous fisheries corridor and increase the fisheries carrying capacity of the Ten Mile River ecosystem.

b. The project will have no known negative impacts on any State or Federal rare or endangered species.

c. The project at Turner Reservoir Dam and Omega Dam will have no known negative impacts on any prehistoric archaeological sites recorded by the State of Rhode Island. A Memorandum of Agreement will be prepared concerning the construction of the fishway at Hunts Mill Dam.

d. This project conforms with the Clean Air Act, Rhode Island State Implementation Plan.

e. Sediment loading would be minimized by employing erosion control plans, temporary cofferdams and by scheduling the construction during the seasonal low flow period. Detailed erosion control measures will be in place prior to construction activities.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the Ten-Mile River Aquatic Ecosystem Restoration Project is not a major Federal action significantly affecting the quality of the human environment. Therefore, I have determined that this project is exempt from requirements to prepare an Environmental Impact Statement.

_____ _____

Date **Thomas L. Koning**
Colonel, Corps of Engineers
District Engineer

CLEAN WATER ACT SECTION 404 (b)(1) EVALUATION

NEW ENGLAND DISTRICT
US ARMY CORPS OF ENGINEERS, CONCORD, MA
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

PROJECT: Ten Mile River Ecosystem Restoration Project, East Providence, Rhode Island. Conducted under the US Army Corps of Engineers Authority contained in Section 206 of the 1996 Water Resources Development Act, as amended.

PROJECT MANAGER:	Mr. Richard Heidebrecht	tel. 978-318-8513
FORM COMPLETED BY:	Mr. Ken Levitt	tel. 978-318-8114

DESCRIPTION: The selected plan consists of the construction of Denil fish ladders at each of three dams on the lower Ten Mile River in East Providence, Rhode Island to provide migratory fish passage beyond the Omega Pond Dam at tidewater, the Hunts Mill Dam approximately 2 miles upstream from Omega Pond Dam, and the Turners Reservoir Dam approximately one-half mile upstream from Hunts Mill Dam. Construction will involve excavation of sections of the left bank and stream bed at Omega Pond Dam, the right bank and stream bed at Hunts Mill Dam, and the left bank and stream bed at Turner Reservoir Dam. This will be necessary to provide support footings for the concrete channels, and create temporary access to the work areas. Less than 100 cubic yards of bank material will be excavated at each location and it will either be replaced or disposed of at an approved upland site. Temporary cofferdams and proper erosion control measures will be employed during the construction period. Upon completion of the project, the bank will be stabilized and replanted with native vegetation.

NEW ENGLAND DISTRICT
US ARMY CORPS OF ENGINEERS, CONCORD, MA

PROJECT: Ten Mile River Ecosystem Restoration Project-Conducted under the US Army Corps of Engineers Authority contained in Section 206 of the 1996 Water Resources Development Act, as amended.

CLEAN WATER ACT
Evaluation of Section 404(b)(1) Guidelines

1. Review of Compliance (Section 230.10(a)-(d)).

A review of the permit application indicated that:

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose.

X
YES NO

b. The activity does not appear to:

1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA;

2) jeopardize the existence of Federally listed threatened and endangered species or their habitat; and

3) violate requirements of any Federally designated marine sanctuary.

X
YES NO

c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values.

X
YES NO

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

YES	NO
X	

2. Technical Evaluation Factors (Subparts C-F).

	N/A	Not Signi-ficant	Signi-ficant
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).			
1) Substrate.		X	
2) Suspended particles/turbidity.		X	
3) Water column impacts.		X	
4) Current patterns and water circulation.		X	
5) Normal water fluctuations.	X		
6) Salinity gradients.	X		
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).			
1) Threatened and endangered species		X	
2) Fish, crustaceans, mollusks, and other organisms in the aquatic food web.		X	
3) Other wildlife (mammals, birds, reptiles and amphibians).		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges.	X		
2) Wetlands.		X	
3) Mud flats.		X	
4) Vegetated shallows.		X	
5) Coral reefs.	X		
6) Riffle and pool complexes.		X	
d. Potential Effects on Human Use Characteristics (Subpart F).			
1) Municipal and private water supplies.		X	

2)	Recreational and commercial fisheries.		X	
3)	Water-related recreation.		X	
4)	Aesthetics impacts.		X	
5)	Parks, national and historic monuments, national seashores, wilderness areas, research sites and similar preserves.		X	

Remarks: Explanation of identified significant impacts: See also Environmental Assessment and reference to Memorandum of Agreement with State Historic and Preservation Office; and Findings of No Significant Impact.

3. Evaluation and Testing (Subpart G).

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

1) Physical characteristics.....X

2) Hydrography in relation to known or anticipated sources of contaminants..... X

3) Results from previous testing of the material or similar material in the vicinity of the project..... _

4) Known, significant sources of persistent pesticides from land runoff or percolation.....__

5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA)..... __

6) Public records of significant introduction of contaminants from industries, municipalities, or other sources..__

7) Known existence of substantial

material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities..... X

8) Other sources (specify).....

List appropriate references
See Environmental Assessment

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.

X (YES) ___ (NO)

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

1) Depth of water at disposal site..... NA
2) Current velocity, direction, and variability at disposal site..... NA
3) Degree of turbulence..... NA
4) Water column stratification..... NA
5) Discharge vessel speed and direction..... NA
6) Rate of discharge..... NA
7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)..... NA
8) Number of discharges per unit of time..... NA
9) Other factors affecting rates and patterns of mixing (specify)..... NA

List appropriate references.

See Environmental Assessment, Not applicable. Work involves construction of temporary coffer dams consisting of either portable dams, earth or sandbags.

b. An evaluation of the appropriate factors in 4a above indicated that our disposal sites and/or size of mixing zone are acceptable.

X YES _ NO

5. Actions To Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge. X YES ___ NO

List actions taken.

See Environmental Assessment

6. Factual Determination (Section 230.11).

All review of appropriate information, as identified in items 2-5 above; indicate there is minimal potential for short or long term environmental effects of the proposed discharge as related to:

a. Physical substrate at the disposal site (review sections 2a, 3,4, and 5 above). YES X NO__

b. Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5). YES X NO___

c. Suspended particles/turbidity (review sections 2a, 3, 4, and 5). YES X NO___

d. Contaminant availability (review sections 2a, 3, and 4). YES X NO___

e. Aquatic ecosystem structure, function and organisms (review sections 2b and c, 3, and 5) YES X NO___

f. Proposed disposal site (review sections 2, 4, and 5). YES _X_ NO___

g. Cumulative effects on the aquatic ecosystem. YES _X_ NO____

h. Secondary effects on the aquatic ecosystem. YES _X_ NO____

7. Findings

The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines.....YES _X_ NO____

_____ _____

DATE

Thomas L. Koning
Colonel, Corps of Engineers
District Engineer

RECORD OF NON-APPLICABILITY (RONA)

Emissions Calculations for:

Ten Mile River Ecosystem Restoration Project, East Providence, Rhode Island

GENERAL CONFORMITY - RECORD OF NON-APPLICABILITY

Project/Action Name: **Ten Mile River Ecosystem Restoration Project, East Providence, Rhode Island**

Project/Action Point of Contact: *Lawrence Oliver, Team Leader Project Planning Section telephone: 978-318-8347*

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project/action because:

Total direct and indirect emission from this project/action are estimated at less than 100 tons for Ozone, and are below the conformity threshold value established at 40 CFR 93.153(b) of 100 tons/year of Ozone;

AND

The project/action is not considered regionally significant under 40 CFR 93.153(i).

Supporting documentation and emissions estimates are:

(X) ATTACHED
(X) APPEAR IN THE NEPA DOCUMENTATION (Section VII-K)
( ) OTHER

SIGNED_____
Lawrence Oliver, Team Leader Project Planning Section

General Conformity Review and Emission Inventory for the Ten Mile River Project
(Worst Case Analysis)

	Project Emission Sources and Estimated Power						NOx Emission Estimates		VOC Emission Estimates	
Equipment/Engine Category	# of engines	hp	LF	hrs/day	days of operation	hp-hr	NOx EF (g/hp-hr)	NOx Emissions (tons)	VOC EF (g/hp-hr)	VOC Emissions (tons)
TRK, Flatbed, 8'x20'	1	150	1.00	10	334	501,000	9.200	5.08	1.300	0.72
TRK,Rear Dump Body, 12 cy	1	325	1.00	24	334	2,605,200	9.200	26.42	1.300	3.73
TRK, HWY 50,000GVW 6x4 3 Axel	1	330	1.00	10	334	1,102,200	9.200	11.18	1.300	1.58
LDR, BH, WH 1.75CY FE Bkt	1	330	1.00	10	334	1,102,200	9.200	11.18	1.300	1.58
Dewatering Pump 12" Diesel	2	32	1.00	24	334	513,024	9.200	5.20	1.300	0.74
Crane, Hyd, TRK MTD 90T/114' Boom	1	192	1.00	10	334	641,280	9.200	6.50	1.300	0.92
Drill Rig 16" Dia 35' Depth	1	300	1.00	10	334	1,002,000	9.200	10.16	1.300	1.44
TRK, HWY 8,800GVW 4x4 3/4T-PKUP	1	137	1.00	10	334	457,580	9.200	4.64	1.300	0.66
Chainsaw	1	10	1.00	10	334	33,400	9.200	0.34	1.300	0.05
Air Compr. 375 CFM 100 PSI	1	115	1.00	10	334	384,100	9.200	3.90	1.300	0.55
Hyd Exc BH, Crawler, 55,000 lbs, 1.5CY Bkt	1	188	1.00	10	334	627,920	9.200	6.37	1.300	0.90
							NOx Total	**90.96**	**VOC Total**	**12.85**

Total emissions including employee travel (see next sheet)	**NOx Total**	**91.14**	**VOC Total**	**13.01**

Horsepower Hours
hp-hr = # of engines*hp*LF*hrs/day*days of operation

Load Factors
Load Factor (LF) represents the average percentage of rated horsepower used during a source's operational profile. For this worst case estimate, LF is held at 1 for all equipment. Typical is 0.4 to 0.6

Days of Operations
See Assumptions in following sheet.

Emission Factors
NOx Emissions Factor (EF) for Off-Road Construction Equipment is 9.20 g/hp-hr
VOC Emissions Factor (EF) for Off-Road Construction Equipment is 1.30 g/hp-hr

Emissions (g) = Power Demand (hp-hr) * Emission Factor (g/hp-hr)

Emissions (tons) = Emissions (g) * (1 ton/907200 g)

Pollutant Emissions from Employee Vehicles

Assumptions:

Average trip distance (1 way) is 25 miles.
Average NOx vehicle emission factor is 0.96 g/mile.
Average VOC vehicle emission factor is 0.84 g/mile.
Work crew comprised of 10 people.
Every member of the work crew drives their own vehicle.
Project construction perio 18 months.
Project construction occurs 5 days per week.
There are 10 holidays in a calendar year.
There are 30 weather days (no work) in a year.

Actual work days = construction duration (days) - weekend days off - holidays off - weather days off.

Construction Duration	Weekend days off	Holidays	Weather Days
547	156	15	45

Actual work days = 331

NOx Calculation: 10 workers * 2 trips/work day * 547 work days * 25 miles/trip * 0.96 g of NOx/mile

Total NOx resulting from employee vehicles = 0.17 tons.

VOC Calculation: 10 workers * 2 trips/work day * 547 work days * 25 miles/trip * 0.84 g of VOC/mile

Total VOCs resulting from employee vehicles = 0.15 tons.

Pollutant emissions associated with employee vehicles derived from data found in: Marine and Land-Based Mobile Source Emission Estimates for 50-Foot Deepening Project. January 2002. Prepared for The Port Authority of New York and New Jersey by Killam Associates and Starcrest Consulting Group, LLC.